Vol. XXI, No. 2 AUGUST, 1948

THE TOOL ENGINEER

REG. U.S. TRADE MARK

OFFICIAL PUBLICATION OF THE ASTE AMERICAN SOCIETY OF TOOL ENGINEERS

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Progress ON THE Pacific
Convention Issue
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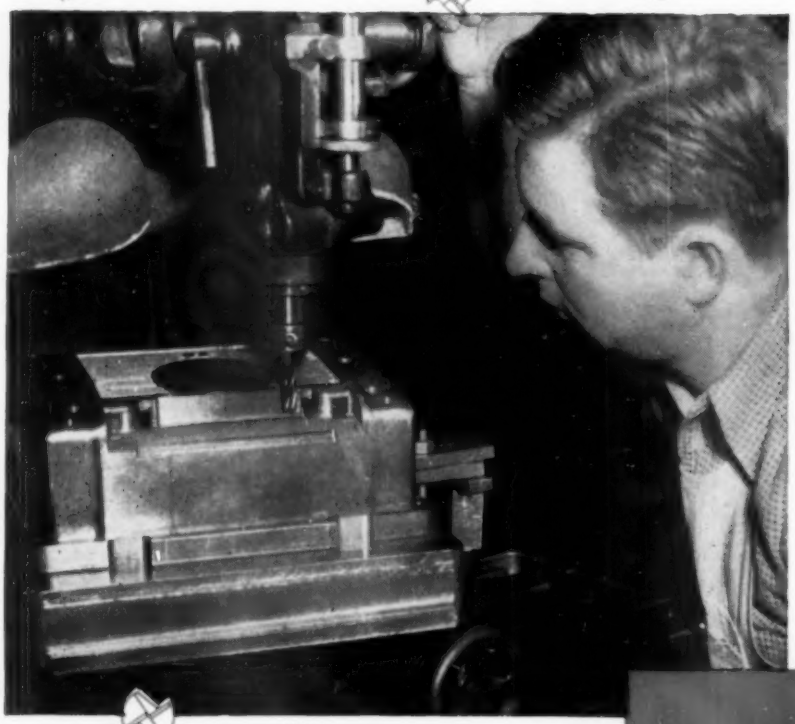
Behind every manufactured product is the tool engineer

If you use fast-spiral end mills, you'll want to try "Hi-Helix"



"Hi-Helix" End Mill at work in General Electric's Plastics Division, milling mold for radio cabinets.

If your plant has discovered the many advantages of using fast-spiral end mills to cut intricate slots, pockets and keyways, you'll get *even better results* when you switch to "Hi-Helix" End Mills, Pratt & Whitney's improvement on the ordinary fast-spiral cutter.

Drawing on its long experience in the design and manufacture of precision tools, Pratt & Whitney has endowed "Hi-Helix" End Mills with special properties that make them cut cleaner, *longer*. Because such tools work continuously at the highest feeds and speeds, "Hi-Helix" End Mills are made only of high quality high-speed steel, hardened for maximum performance under any conditions. *And an exclusive P&W surface-treatment keeps "Hi-Helix" spirals from loading up or galling . . . keeps cutting edges always clear of chips . . . increases wear-resistance.*

Available in single-end or double-end styles, in both regular and two-lipped types, and in a complete range of sizes, "Hi-Helix" End Mills reduce over-all costs on the most intricate milling . . . deliver finishes so fine that hand-work is drastically minimized. It will pay you to investigate. For free descriptive booklet, write

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Division Niles-Bement-Pond Co.
WEST HARTFORD 1, CONNECTICUT

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Hi-Helix End Mills

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The Tool Engineer

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August, 1948

Vol. XI, No. 2

Editorial

Progress on the Pacific

IT'S CALIFORNIA here we come—and not just to bask under sunny skies and enjoy the scenic beauty.

For the first time since the war, ASTE members will have an opportunity to review the tremendous industrial expansion and development on the West Coast. The Semi-Annual Convention in Los Angeles in October will provide that opportunity.

For most of us, it will be the happy combination of a wonderful vacation trip and an educational tour during which we will be able to exchange ideas and information with our fellow tool engineers in the West.

We all know that the growth of western industry wrote one of the most dramatic chapters in the thrilling story of war-born production facilities. The giant aircraft factories which gave birth to the big bombers and sturdy fighters have become the primary source of planes to meet the needs of peacetime aviation. In these plants are some of the country's outstanding research and experimental laboratories, now blueprinting the aircraft of the future—both commercial and military.

Many of the country's leading industries, formerly centered in the East and Middle West have expanded westward in the post war era to reap from the coastal areas' industrial growth.

All of this means that the plant tours in and around Los Angeles will give to tool engineers the opportunity of seeing the very latest, most modern tools and machines as they are adapted to a wide variety of operations.

Mass production and tool engineering are an old story in the East and the industrial Middle West. In the West, they are comparatively new—but they have come rapidly into their own on the same large scale that our western friends do and enjoy almost everything else, from distances to climate. Tool engineers will naturally be interested in these new plants and their activities. The simple answer to this interest is, of course, to attend the Semi-Annual Convention.

Obviously, these new industries did not grow up like Topsy. They grew up under the careful guidance of engineers and executives who knew what they were doing. These men have accumulated a wealth of varied experience in a relatively short time and there is much that any of us in tool engineering or any phase of production can learn by listening to them and talking with them.

The technical sessions of the Convention will provide that rare opportunity.

In other words, the ASTE's Semi-Annual Meeting this year offers to its members many things of top professional value that they could not possibly obtain otherwise. In addition the California site will provide the majority of the registrants with an enjoyable cross country trip, especially those who make it in the special train. This will offer an unusual opportunity for renewing old acquaintances and making new friendships with people whose interests are the same as yours.

Tool engineers, you owe it to yourselves as members of the profession to see—Progress on the Pacific.

I. F. Holland

President 1948-49

THE TOOL ENGINEER is published monthly in the interest of the members of the American Society of Tool Engineers. Entered as second class matter, November 4, 1947, at the post office at Milwaukee, Wisconsin, under the Act of March 3, 1879. Yearly subscription, $2.00. Non-members, $6.00. Canada, $6.50; all other foreign countries, $5.00 per year.
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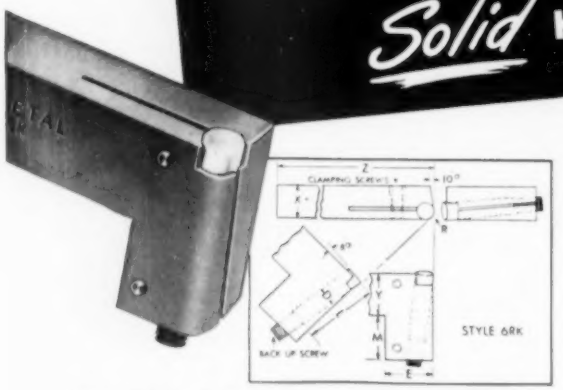
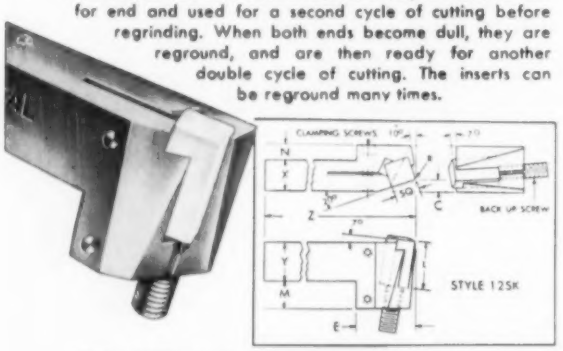
Another **KENNAMETAL** Development

KENNAMATIC Tools

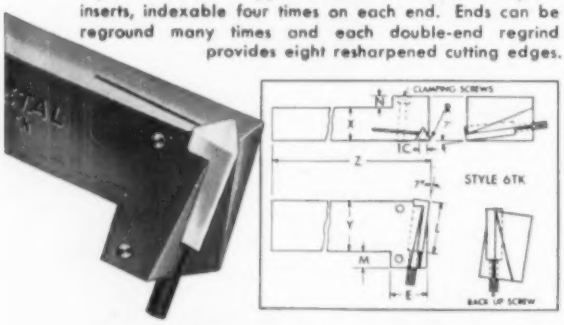
having CLAMPED-IN, INDEXABLE *Solid* KENNAMETAL *Inserts*



Style 6RK (and opposite hand 3RK) have cylindrical inserts that can be indexed several times, then turned end for end and used for a second cycle of cutting before regrinding. When both ends become dull, they are reground, and are then ready for another double cycle of cutting. The inserts can be reground many times.



Style 12SK (and opposite hand 11SK) have square inserts, indexable four times on each end. Ends can be reground many times and each double-end regrind provides eight resharpened cutting edges.



Style 6TK (and opposite hand 3TK) have triangular inserts, indexable three times on each end. Ends can be reground many times—and each double-end regrind provides six resharpened cutting edges.

Solid, Mechanically-Held Kennametal Inserts

Inserts are mechanically-held, *vertically*—best use is made of high compressive strength of Kennametal (up to 800,000 PSI); brazing strains are eliminated.

Indexable Cutting Edges

Can be indexed 6 to 12 times before regrinding. Indexing is a simple operation, and does not require changing tool holder.

Replaceable Inserts

Few standard sizes can be used in a variety of tools and jobs—simplifies tool control; reduces toolroom stocks.

Simplified Regrinding

Resharpening merely requires squaring off both ends of insert, and grinding chip breaker if required—reduces load and confusion in grinding room.

Permanent Setting

Insert can be indexed or changed without changing tool holder setting—less set-up and machine down time.

The overall result of Kennamatic tooling is that higher production rates can be reached, and maintained, at much less cost. Let our engineers suggest suitable applications.

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SUPERIOR CEMENTED CARBIDES

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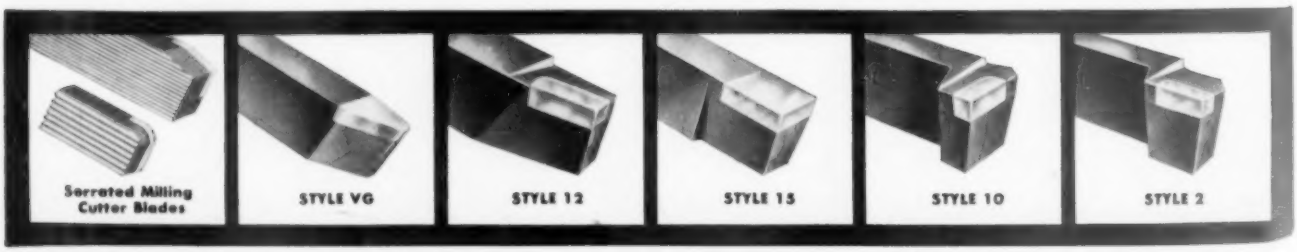
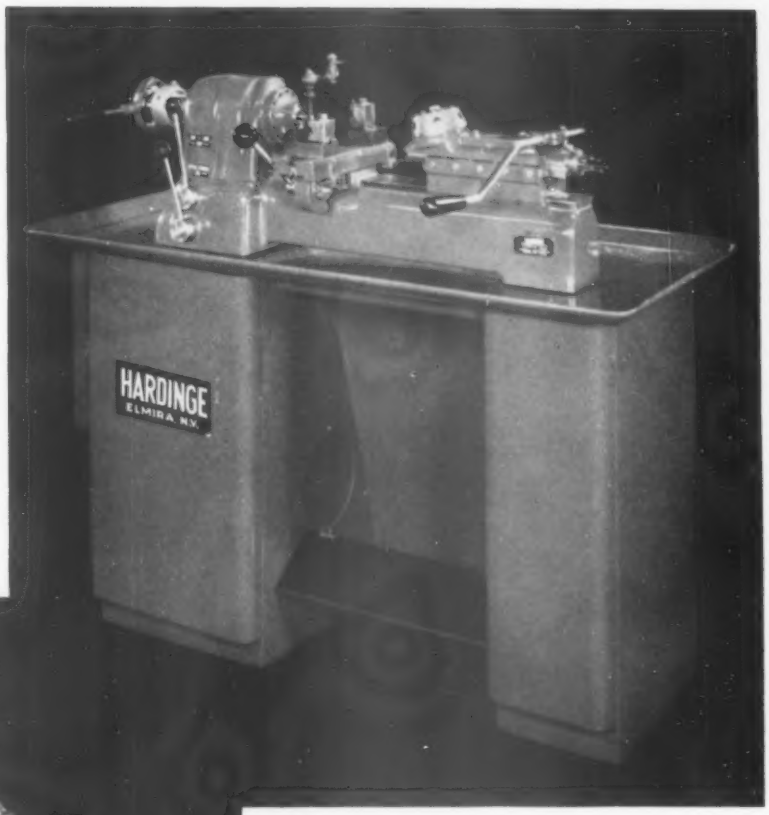
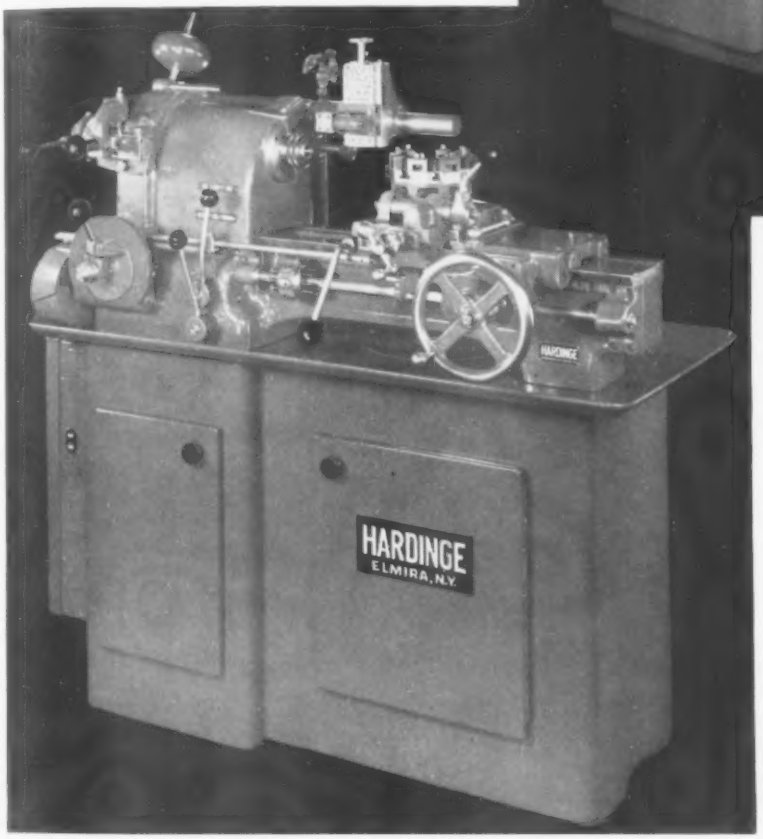


HARDINGE
ELMIRA, N.Y.

HIGH SPEED
PRECISION PRODUCTION MACHINES





SECOND OPERATION MACHINE: 1" collet, 6" step chuck, 5" jaw chuck capacity; eight spindle speeds to 4000 r.p.m.; preloaded ball bearing construction for spindle and turret; hardened and precision ground steel ways; turret and cross slide operating levers are adjustable to suit the operator.

Write for descriptive bulletin DSM59.

MULTI-OPERATION CHUCKING MACHINE: This machine has the same capacity as the Second Operation Machine. In addition, it has an eight-position turret, production threading head and power feed for the carriage.

Write today for bulletin HP which shows how this machine can handle various jobs, using standard tool bits only . . . for low-cost tooling.

The production of precision parts today requires tool room accuracy with high speed operation to reduce and then maintain lower costs. The above machines are both designed to increase the output of parts to extremely close tolerance and finish specifications. The precision qualities of these machines, combined with the simplicity of operation, assure lower costs.

HARDINGE BROTHERS, INC., ELMIRA, N. Y.

"PERFORMANCE HAS ESTABLISHED LEADERSHIP FOR HARDINGE"

Hardinge Machinery Representatives: Seattle, Dawson Machinery Co.; Portland, Portland Machinery Co.; San Francisco, Moore Machinery Co.; Los Angeles, Eccles-Germain Machinery Co. Collets, Feed Fingers, Cut-off Tools: Hardinge Brothers, Inc., 5700 Paloma Ave., Los Angeles.

THE BELT METHOD IS THE BETTER METHOD
. . . AND THE BETTER BELT IS *METALITE*®

Case No. 4*

Electroplater Cuts Costs 65%

Because of the tremendous number of set-up wheel polishing operations found in the electroplating trade, the success of belt-backstand conversion in this field has been especially notable. Here, in addition to the savings on production costs, raw material costs and production increases, a severe shortage of skilled polishers has been alleviated in many plants through the use of abrasive belts which permit less-skilled operators to perform critical polishing operations with amazing success.

The Operation — Rough and finish cast iron furnace-grills prior to plating.

Original Method — #40, #60, #120 set-up wheels.

Belt-Backstand Method — Porter-Cable ABS Backstand. Behr-Manning Metalite Cloth Heavy Duty Durabonded Belts #40-X, #100-X. Behr-Manning Canvas Contact Wheels 12" x 4" x 1¼", hard and soft density.

Improvement — 1. Abrasive cost reduced 65.4%.
2. Production increased 26%.
3. Finish improved substantially.
4. Flatness held.
5. Subsequent plating failures reduced measurably.

Remarks — Management "delighted" (testimonial letter on file). Operator's opinion "less effort required."

Write or wire or phone us for your own free demonstration of the belt method with better Metalite Cloth belts.

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QUALITY COATED ABRASIVES SINCE 1872

* FOR THE COMPLETE SERIES OF 7 CASE STUDIES WRITE FOR OUR 12-PAGE BOOKLET "PRODUCTION TALKS BACKSTANDS"

BIG

or small . . .

A Besly Grinder Grinds Them All *for*

BESLY GRINDERS

APPLETON ELECTRIC PRODUCTS

No. 372-53" Besly Vertical Spindle Disc Grinder equipped for grinding UNILETS manufactured by the Wisconsin-Appleton Co. at South Milwaukee, Wis., operated as Plant 2 of the Appleton Electric Company, Chicago, Ill. All sizes are handled on this one grinder. Production rate varies from 100 — 200 pieces per hour for the 4" size to 1800 pieces per hour on smaller sizes.

The unusual versatility and adaptability of Besly Grinders is revealed by this standard-type Vertical Spindle Disc Grinder equipped with a special power-driven three-channel continuous chain feeder unit. Now, the Appleton Electric Company can finish *all* Rectangular and Form 35 UNILETS on one grinder. A single pass produces the required smooth, flat surface.

Talk It Over with a BESLY ENGINEER!

Many equally productive applications are possible with this basic design. Perhaps a 372-53" Besly is the answer to your production problem. Why not discuss the possibilities with a Besly engineer?

You'll Do BETTER with BESLY

BESLY GRINDERS AND ACCESSORIES
BESLY TAPS • BESLY TITAN ABRASIVE WHEELS

CHARLES H. BESLY AND COMPANY • 118-124 N. Clinton St., Chicago 6, Ill. • Factory: Beloit, Wis.

THE TEAM WHICH HAS DEVELOPED ELECTRIC FIRING, AND THE "SCORE" IT HAS PRODUCED

Standing: E. Hediger, GLOBAR Division — D. G. Foot, Abrasive Division — I. M. Logan, Refractories Division
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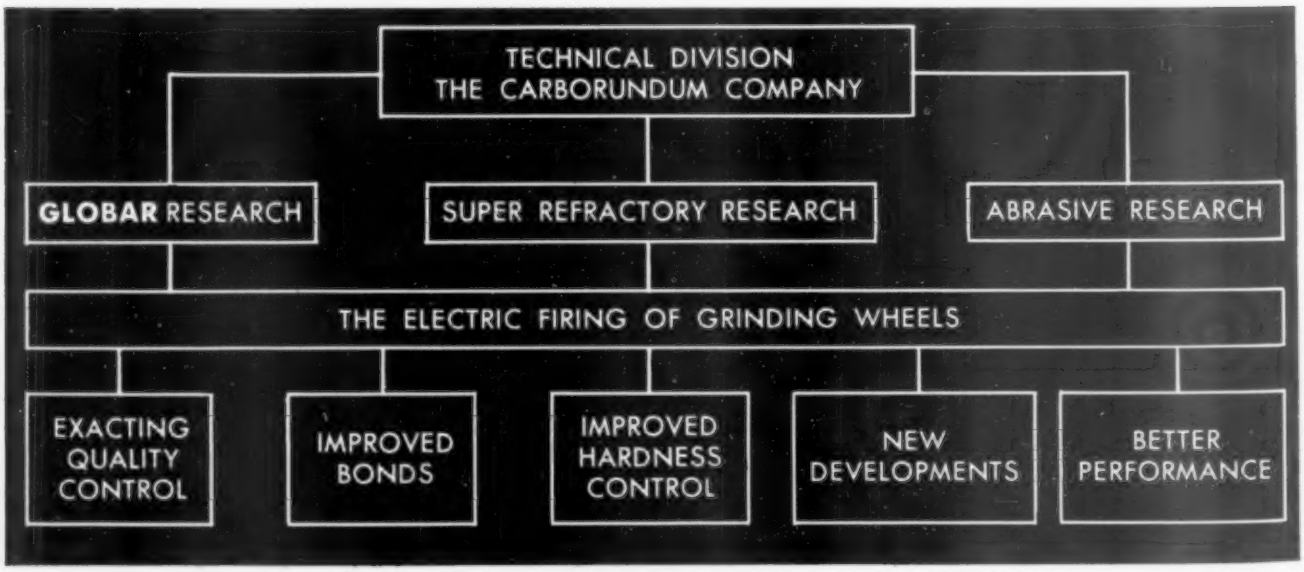

HERE IS NEWS you should have

ANNOUNCING the electric firing of vitrified grinding wheels

As a user of abrasives, you are the direct beneficiary of a sensational improvement in the production of grinding wheels. As the leading name in abrasives it is natural that the first news of this process should come from us.

Out of a long period of experimentation, the electric firing of grinding wheels has been brought to the level of large-scale production. The benefits to you are five-fold.

1 EXACTING QUALITY. By electric firing, many factors are eliminated which heretofore jeopardized strict production requirements. Our electric kilns assure a firing curve that would satisfy the most demanding furnace foreman and contribute to a steady production of perfect wheels.

2 IMPROVED BONDS. Electric furnace procedure provides considerably more latitude in the development and selection of bonds for vitrified abrasive wheels.

3 BETTER HARDNESS CONTROL. Improvements in product quality, which are permanent standards of CARBORUNDUM engineering, have been combined with more efficient production techniques. By means of this new firing method, duplication of wheel quality is controlled to an exact degree.

4 NEW DEVELOPMENTS. An advancement of this kind will naturally encourage and stimulate our technicians. We confidentially expect to announce startling improvements in abrasive products soon.

5 BETTER PERFORMANCE. Abrasives—as good as they are...are being improved continuously. And our technical parade will continue to advance, producing better abrasives for American Industry, which in turn is producing better products and services for the world.

Only the combined resources of The Carborundum Company could effect the achievement. Electric firing of such accuracy calls for GLOBAR electric heating elements. A kiln which operates at such exacting temperatures demands CARBOFRAX and MULLFRAX super refractories.

This is a technical development of large proportions. It could be brought to fulfillment only by a Technical Division with the capacity and facilities for turning up new knowledge in the fields of chemical, electrical and abrasive engineering. The Carborundum Company, Niagara Falls, New York.

CARBORUNDUM

TRADE MARK

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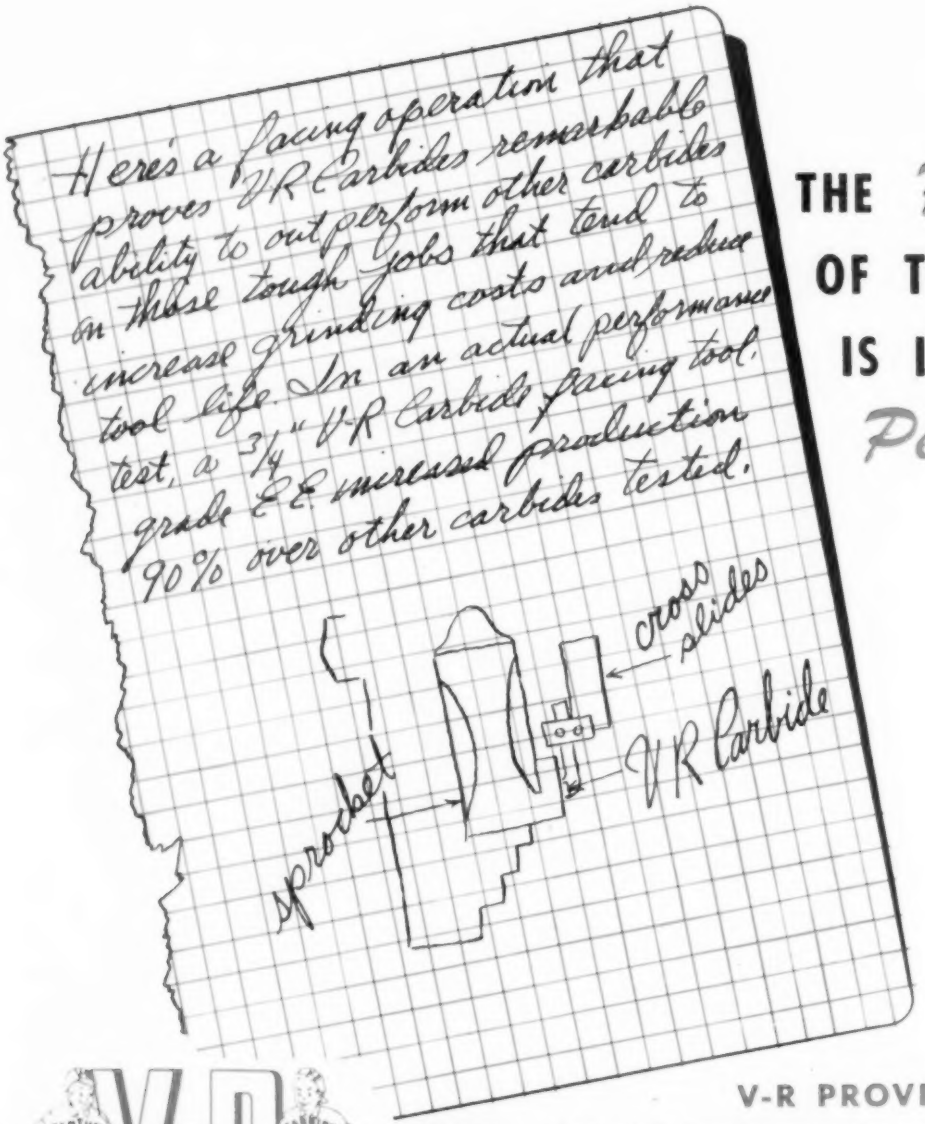
Here's a facing operation that proves V-R Carbides remarkable ability to outperform other carbides on those tough jobs that tend to increase grinding costs and reduce tool life. In an actual performance test, a 3/4" V-R Carbide facing tool, grade EE increased production 90% over other carbides tested.
cross slides
sprocket
V-R Carbide

THE *Proof* OF THE CARBIDE IS IN THE *Performance*

V-R

V-R PROVEN PERFORMANCE

MACHINE: Potter & Johnson Automatic, 6 years old
MATERIAL: Tough, Scaly Steel Castings
OPERATION: Facing sprockets. 1/8" to 1/4" depth of cut from 7 3/4" O.D. to 4 1/8" I.D.
TOOLS: 3/4" Carbide Tipped Facing Tool

The Proof:

	V-R Carbide, Grade EE	Carbide "A"	Carbide "B"	Carbide "C"
S.F.M.:	194 to 116	194 to 116	194 to 116	194 to 116
Feed per Rev.:	Hand Feed	Hand Feed	Hand Feed	Hand Feed
Depth of Cut:	1/8" to 1/4"	1/8" to 1/4"	1/8" to 1/4"	1/8" to 1/4"
Pcs. per Grind:	100	8	10	9
Remarks:	V-R Carbide finished the remainder of 500 sprockets with a single tool, reground only 5 times.			

Many times the application of V-R Carbides to a particularly difficult problem is unique—the result of an unprecedented need arising from some new development in industry—and V-R Carbides provide sure, economical production. Call your nearest V-R Field Engineer today for a quick, economical solution to YOUR tool problem.

VASCOLOY-RAMET CORPORATION WAUKEGAN ILLINOIS
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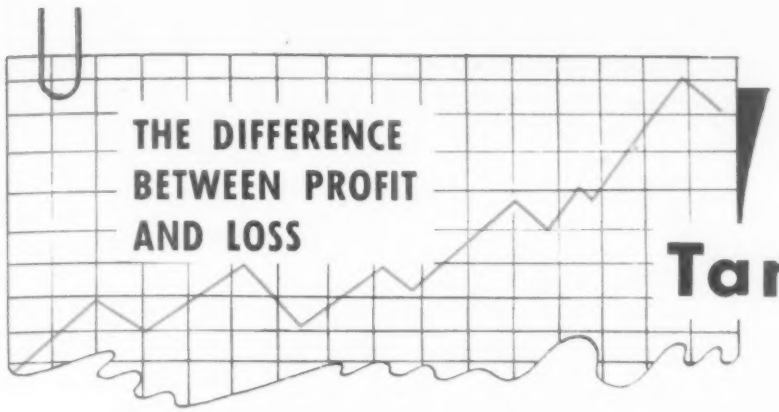
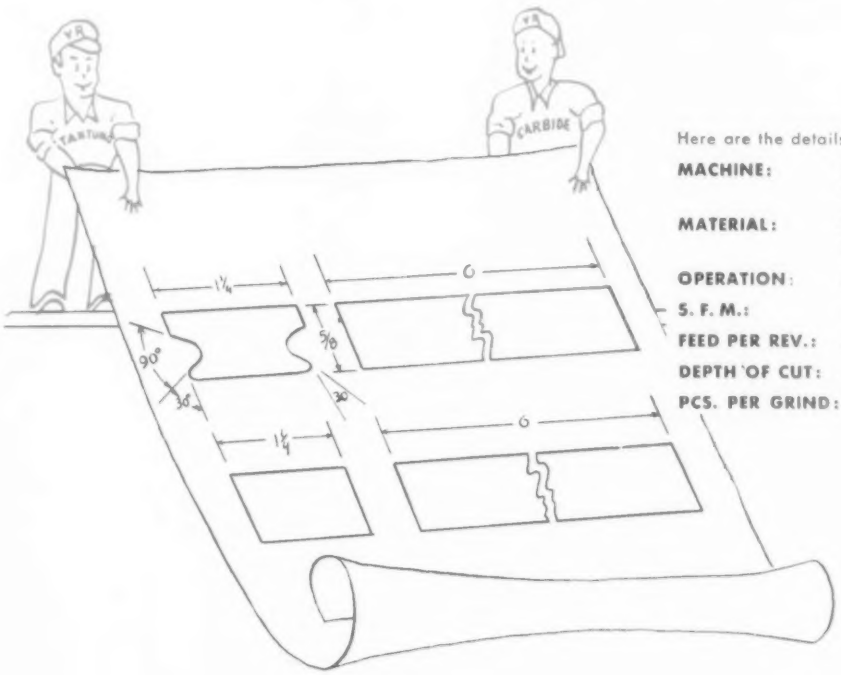


Here is the case of a manufacturer faced with the problem of turning out 30 pieces per hour on a 30-year old vertical turret lathe . . . and the additional problem of keeping grinding room cost at a minimum. Using this old lathe equipped with high speed steel dovetail tools to face stainless steel bands, he was able to produce only 207 bands in 8 hours . . . and for each 8 hours spent in actual operating time, an additional 4 hours had to be spent in the grinding room sharpening worn tools. Realizing the costliness of this operation, the manufacturer turned to TANTUNG. Using solid preformed TANTUNG ⅝ x 1¼ x 6 dovetail tools on the same 30-year old vertical turret lathe his output for the next 8 hours was 336 pieces, before requiring regrinding.



Here are the details of the operation:

MACHINE:	36" 30-year old Vertical Turret Lathe
MATERIAL:	Stainless Steel Bands 17½" i. d. x 18" o. d. x 1" thick
OPERATION:	Facing Edges
S. F. M.:	195
FEED PER REV.:	.007
DEPTH OF CUT:	.187
PCS. PER GRIND:	TanTung — 420. High Speed Steel — 30

TANTUNG—tough, shock-resistant non-ferrous cast alloy, which can be cast to form requiring a minimum of grinding before use, performs at far greater speeds and feeds than high speed steels. To increase production without increasing cost . . . on your present equipment . . . ask your nearest V-R Field Engineer about **TANTUNG**. Call or write us today!

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CUT HEAVY *and* LIGHT STOCK *Both*

NIAGARA

You don't have to adjust knife clearance on Niagara Power Squaring Shears every time you cut a different thickness of stock! Niagara capacity ratings are maximum capacity ratings, and they cut any thickness of stock up to their top rating WITHOUT TINKERING WITH THE KNIFE ADJUSTMENT.

And to prove it, look at the photograph at right...one man is cutting a 20 gage sheet and the other is cutting 5/8" plate BOTH AT THE SAME TIME, AND WITH THE SAME KNIFE ADJUSTMENT, AND WITH THE SAME GOOD RESULTS.

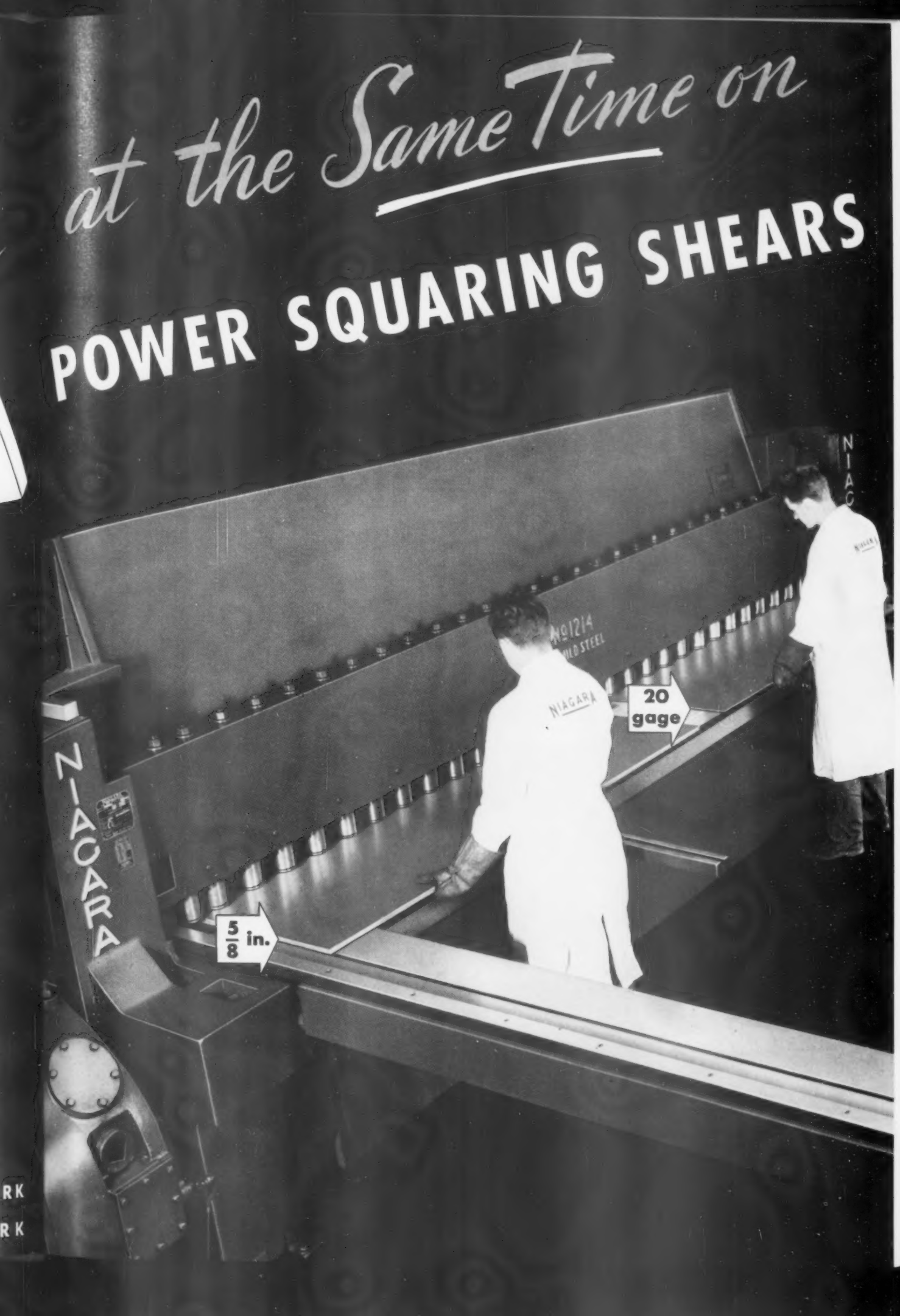
This is done daily in our own plant on our own work. We gladly demonstrate.

It speaks for Niagara design, Niagara rigidity, Niagara strength and the recognized ability of Niagara shears to deliver more working strokes per hour.

Write for bulletin.

NIAGARA MACHINE AND TOOL WORKS, BUFFALO 11, NEW YORK

DISTRICT OFFICES: DETROIT, CLEVELAND, NEW YORK


at the Same Time on
POWER SQUARING SHEARS
NIAGARA
NIAGARA
20 gage
5/8 in.

NEW HEALD BORE-MATICS BOOST PRODUCTION 167%

...and Manufacturer Gets Lower Costs—Higher Quality Product—Finer Finish

Here's another example of how manufacturers are reducing costs—improving quality with the new Heald Bore-Matics.

After replacing the slow, fatiguing equipment previously used by new, fast, easy-to-operate Bore-Matics, a valve manufacturer was able to increase production 167%! Besides this big saving in direct costs, finish was greatly improved, permitting the elimination of an inspection operation before assembly.

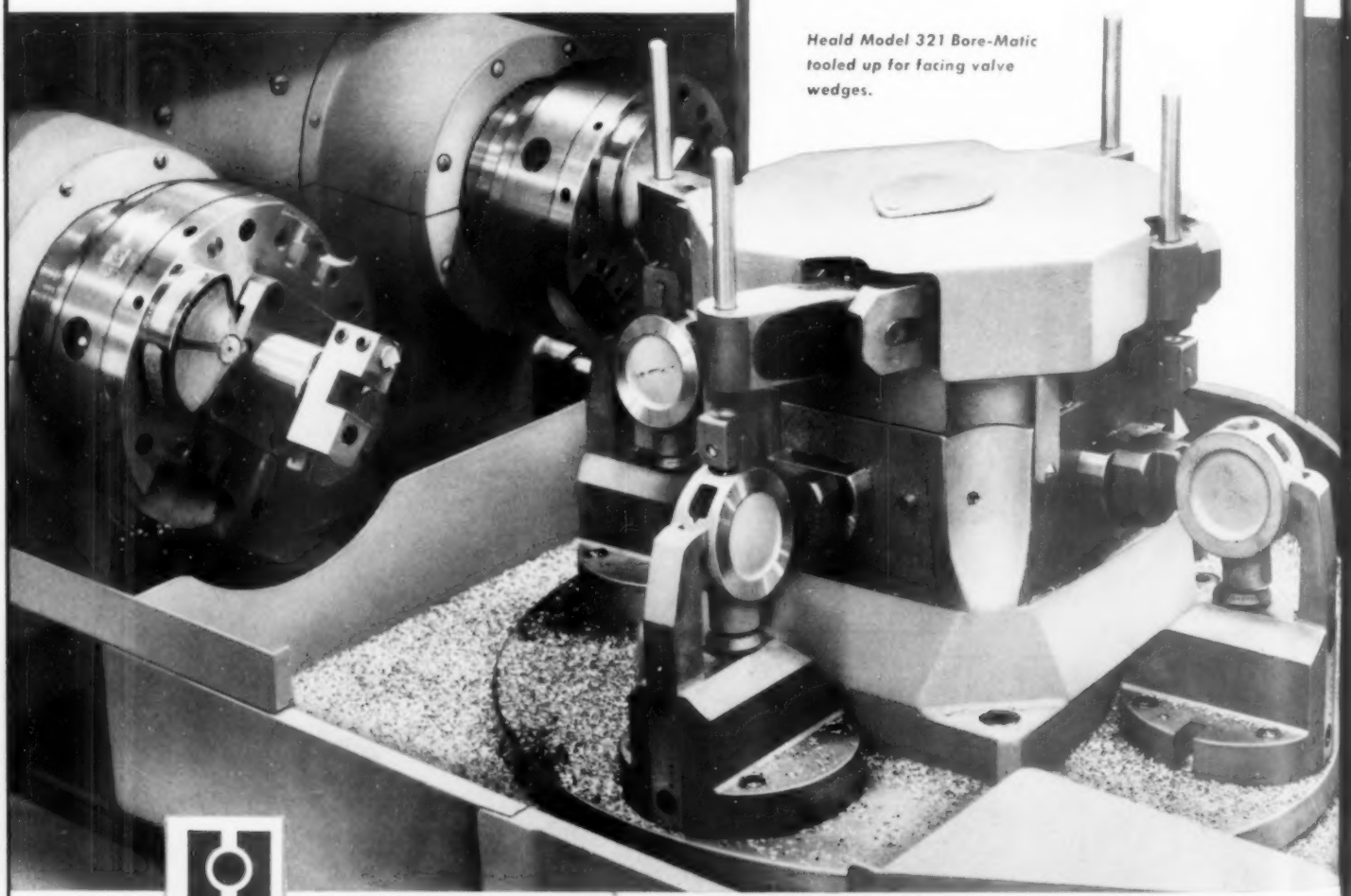
Both valve wedges and bodies are borized—the setup below illustrating the facing operation on wedges. Opposite faces are finished simultaneously by two boringheads with cross feed units. Fixture has four stations permitting loading during the facing operations.

These new Heald Bore-Matics offer the same opportunity for lowering *your costs*—whatever you manufacture. For complete information, contact your nearest Heald representative, or call on us here at Worcester.

IMPROVE YOUR PRODUCT— LOWER YOUR COSTS—

with these New Bore-Matic features

As in this installation, you too can improve product quality, increase production and cut costs by finishing parts on Heald Bore-Matics. Such features as—faster table traverse—higher speeds—quicker starting and stopping—constant feeds—low temperature hydraulic system—ventilated base and bridges—cool running heads—perfected way lubrication—universal valve manifold—leakproof piping, and many more—can save you time and money . . . they're worth investigating.



Heald Model 321 Bore-Matic tooled up for facing valve wedges.

HEALD

THE HEALD MACHINE COMPANY, Worcester 6, Mass.

Branch Offices in Chicago • Cleveland • Dayton • Detroit • Indianapolis • Lansing • New York

ADMIRE THEIR PERFECTION...
PROFIT BY THEIR ACCURACY

STARRETT
VERNIER GAGES

Starrett Vernier Height Gages, Depth Gages, Calipers, Gear Tooth Calipers, Dovetail Calipers and other Vernier tools are the finest example of the skilled toolmaker's art. Their accuracy goes without question, but along with unfailing accuracy they bring the perfection of design that speeds precision work. You'll find that Starrett Verniers are standard equipment in the best shops wherever you go.

Write for Starrett Catalog E

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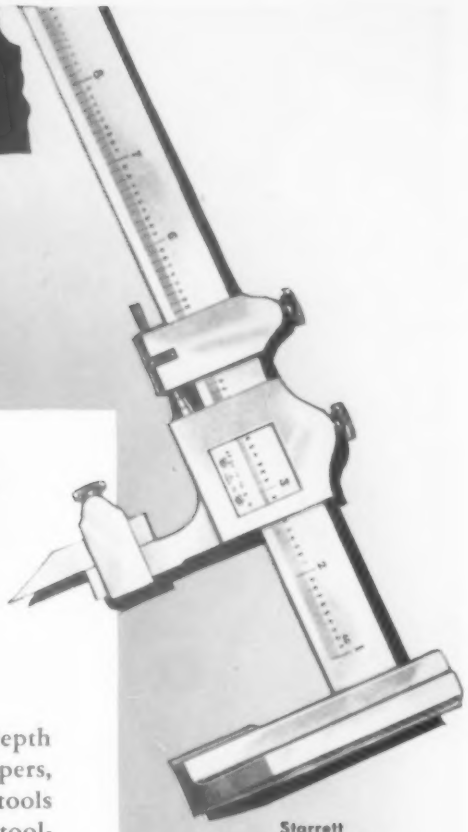
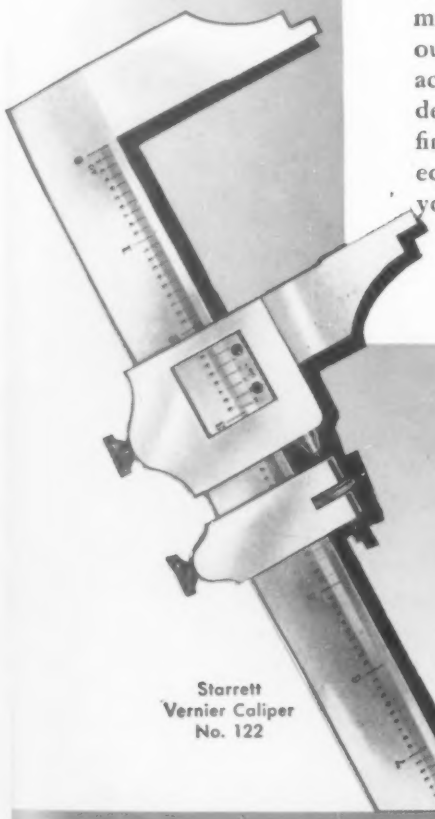
Vernier Depth Gage
No. 448



Starrett
Vernier Height Gage
No. 454



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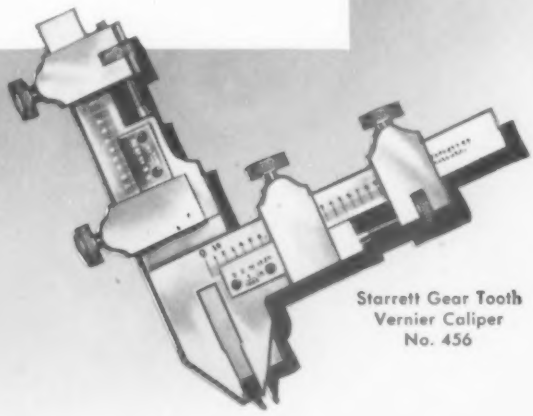

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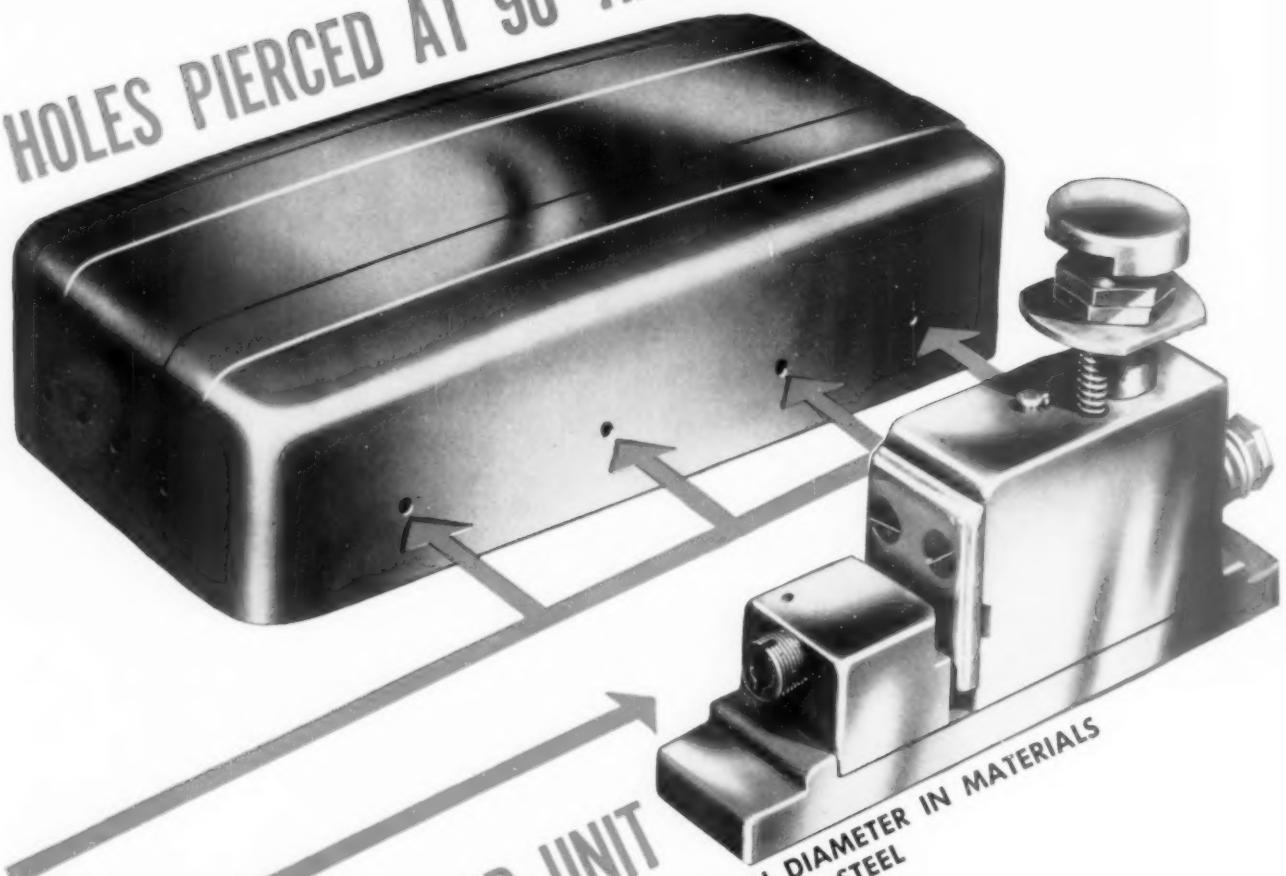

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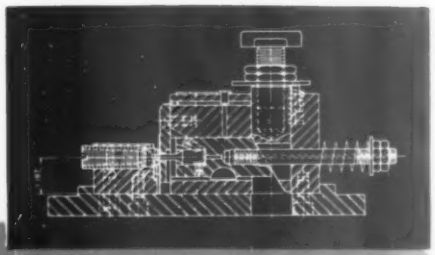
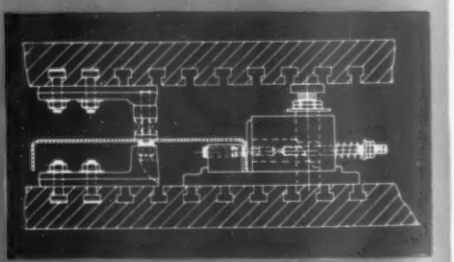


Detailed drawing showing operation of HU-50 90° Perforating Unit.



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When and How to Use Cast Iron*

Through Modern Metallurgy, Gray Iron Has Become a Dependable Engineering Material

By T. E. Eagan

GRAY IRON, which metallurgists have improved to the point where it is an engineering material that, properly applied, will give outstanding performance and can be broadly called steel plus graphite. Microscopically, a good grade of material will appear as shown in Fig. 1. The gray streaks are graphite and the "thumb print" material is that found in a piece of annealed .90 carbon steel.

The graphite, which occupies 11.00 to 17.00% of the volume of the metal (depending on analysis and cooling rate of the casting) largely controls its physical characteristics. If all of the graphite were located in one spot in the center of a casting, as shown at top, Fig. 3, it would have little effect on the strength. If, however, it were put in as a slab across the piece, as shown below, we would have practically no strength. Therefore, we can produce various strengths of gray iron by controlling the distribution of the graphite, and its amount.

T. E. Eagan **is Chief Metallurgist, Cooper-Bessemer Corporation, Grove City, Pa., and Past Chairman, Gray Iron Division, American Foundrymen's Association. This article is a resume of a paper presented at the joint session of the American Society of Tool Engineers and the American Foundrymen's Ass'n at the 1947 Machine Tool Congress, held concurrently with the NMTBA Show.**

The matrix metal will have the tensile strength of steel, which has the same analysis and microstructure and may vary from pure iron—or almost a pure iron—with a tensile strength of around 40,000 psi to a pearlitic steel with a tensile strength of 120,000 psi.

Since, to a certain extent, the tensile strength of gray iron indicates the other properties desired, the general rule has been to specify it as the controlling criterion for the purchase of castings. This is done mostly by using the ASTM specification A-48, which gives the various classes of gray iron normally available. The tensile strength thus designated is taken from a separately cast test bar, not attached to the casting, and various sizes of these test bars are used, depending on the section thickness of these castings. Table 1 gives a summary of the specification.

Why seven different classes of gray iron? In the first place,

TABLE 1

Class	Tensile Strength Min. p.s.i.	Usual Minimum Wall Thickness—Inches
No. 20	20,000	1/8
No. 25	25,000	1/8
No. 30	30,000	1/4
No. 35	35,000	3/8
No. 40	40,000	1/2
No. 50	50,000	1/2
No. 60	60,000	3/4

Sizes of Section, Inches	Nominal Dia. of Test Bar, Inches
0.50 and under	0.875
0.51 to 1.00	1.20
1.01 to 2.00	2.00
over 2.00*	

*Larger bars by agreement between manufacturer and purchaser.

*Paper presented to a joint meeting of American Society of Tool Engineers and American Foundrymen's Association, Sherman Hotel, Chicago, Ill., September 19, 1947

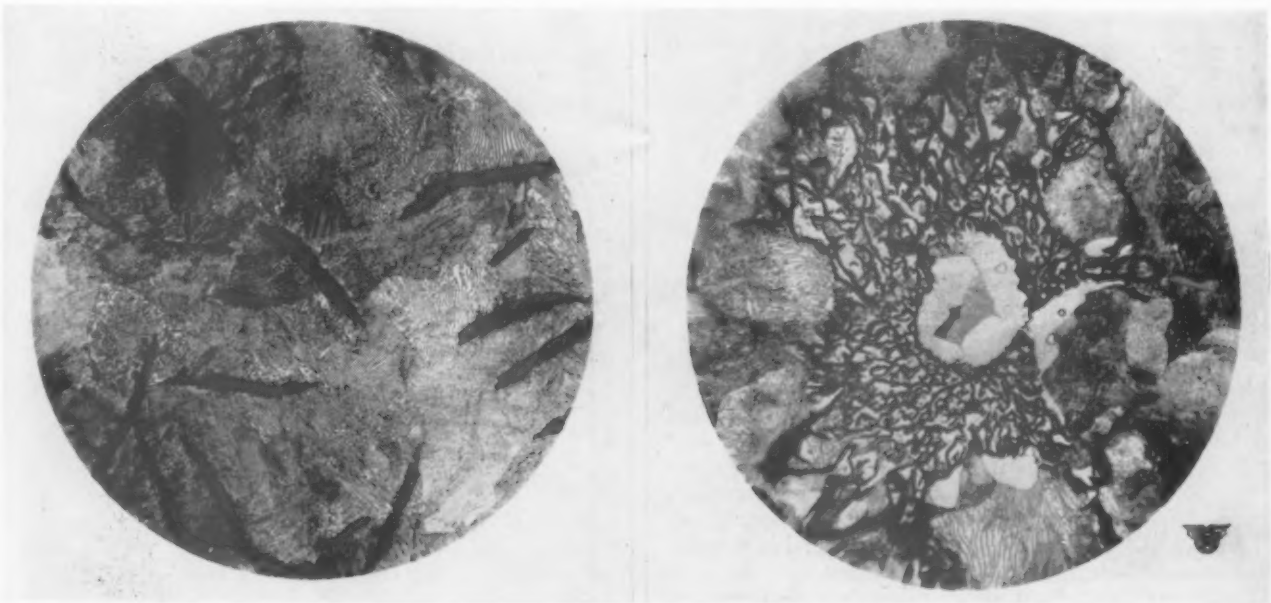


FIG. 1, at left, a microstructure of a good grade of cast iron. At right, FIG. 2 shows a microstructure of gray iron having poor wear resistance. Both magnified 500 times.

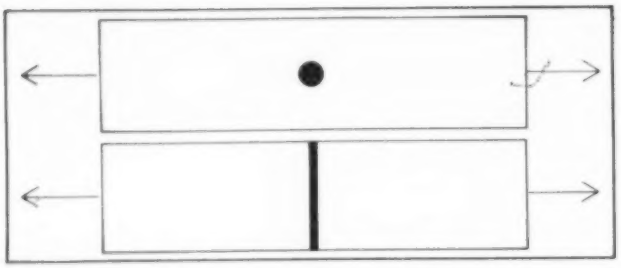


FIG. 3 illustrates the influence of graphite on the tensile properties of gray iron. Where the graphite is concentrated in one spot near the center of a casting, there would be no appreciable loss of strength. If, however, it occurs as a slab across the casting, there would be no strength whatsoever.

the lower the class of iron designated, the cheaper it is; thus, there is the problem of economies. Secondly, the higher classes of iron are very difficult to cast into thin sections. The table indicates the usual minimum sections that can be economically used; however, they are not mandatory. For thinner sections than those indicated, the designer must provide gating to allow the iron to flow through these thin sections.

The fundamental thing that controls the tensile strength of the material in any gray iron casting is the rate at which it cools from the molten metal down to a temperature around 1000 degrees F. It can therefore be definitely stated that, for any given analysis of material, the tensile strength obtained in the casting is a function of its cooling rate.

Unfortunately there is not a great deal one can do about the cooling rate because it is primarily controlled by the design of the casting, the size of the flask used, the method of gating and, among other things, the sand used. To obtain any required tensile strength, therefore, the chemical analysis must be controlled. It is entirely possible to do this, although the practical aspects of the methods used are very complicated and require a considerable knowledge of metallurgy. However, it is being done daily with success.

Properties of Gray Iron

Yield Point: In design work, it is usual to avoid stresses higher than the yield point of the material if the material is to be subjected to static loading. The yield point of gray iron, which is comparable to that of low carbon cast steel, is very close to the tensile strength; thus, it is possible to use the material at higher stresses.

Compression Strength: One of the outstanding characteristics of gray iron is its compression strength—actually much greater than that of steel. For that matter, gray iron in all classes is much stronger than cast steel when used in compression.

Modulus of Elasticity: In design work, the modulus of elasticity is an important factor in most calculations. The modulus of elasticity of gray iron runs somewhere between 12 million and 22 million psi, depending on the tensile strength, the amount and distribution of the graphite, and microstructure of the matrix. However, these figures must be used with discretion because cast iron is a heterogeneous material and does not fulfill the requirements of homogeneity, isotropy, and elasticity as required by the elastic theory.

In many cases, cast iron behaves quite differently than would be expected from the elastic theory. We can only state, here, that the shape of the section influences the stress distribution and that, as the load increments are increased, the neutral axis shifts and the stress distribution line follows a curve instead of a straight line such as is found in a homogeneous material such as steel.

Endurance Limit: Parts subjected to dynamic forces are usually designed so that the stresses imposed are below the endurance or fatigue limit. In gray iron, the theoretical endurance limit is between 35 and 50 per cent of the tensile strength although, for most sections, an arbitrary figure of 40% of the tensile strength can be safely used.

As all designers and engineers should know, the use of the theoretical endurance limit is subject to modification because of design and service requirements. This is true of any material; however, let us consider one or two of the factors as they affect gray iron.

Notch Sensitivity: Gray iron is much less notch sensitive than steel. This is amply illustrated in Fig. 4, which shows the endurance limit in reverse bending of steel unnotched and notched as shown. The steel was SAE 1040, heat treated to 80,000 psi tensile strength. The tensile strength of the gray iron was 49,000 psi. In the case of steel, the reduction of the endurance limit caused by the notches was 50%, while in the case of iron the reduction was 21%.

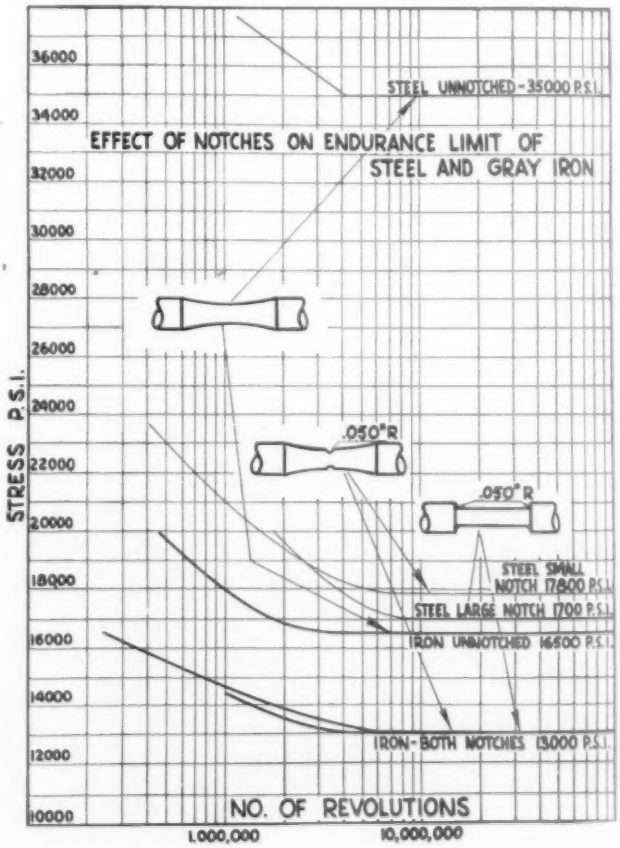
Comparisons—Steel vs. Cast Iron

Let us now consider how this applies to the use of cast iron. Take, for example, a piece that could be made of steel or of cast iron. The steel would have a tensile strength of 80,000 psi and, in the case in hand, would have an endurance limit of 35,000 psi. Because of the notches in the design, we would have to use the maximum allowable stress of 17,000 psi.

Now, the cast iron has a tensile strength of 49,000 psi and an endurance limit of 16,500, but, because of its non-notch sensitiveness we can use as a maximum allowable stress 13,000 psi, which is only 3,500 psi less than that for steel. Because of the factor of safety usually used it would be amply safe to use the cast iron in place of the steel.

This is not to be construed as a condemnation of steel, nor

FIG. 4 shows the effect of reverse bending of notched and unnotched steel and cast iron. In the case of S.A.E. 1040 steel, heat treated to 80,000 psi tensile strength, the reduction caused by the notches was 50%, while in the case of cast iron (with a tensile strength of 49,000) the reduction was 21%.



claim that cast gray iron will always take the place of steel. Actual service requirements may indicate that an analysis as given above is incorrect, and that cast steel or forged steel would be much better. The point is that there are many cases where steel castings are specified when gray iron would serve as well, and in such cases it would be a misapplication of steel.

With further reference to the notch effect of stresses, a considerable amount of relief can be effected by proper contouring. However, this contouring must be done intelligently and the use of the new SR-4 strain gages can be of great help.

As an example of what can be done, Fig. 5 is a cast gray iron crankshaft having a tensile strength of over 65,000 psi. The notch effect, at the fillets between the webs and the pins and journals, normally imposes a stress concentration of over 2 to 1 for a forged steel shaft, and 1.75 to 1.00 for this high tensile iron.

By contouring as shown, however, this stress concentration is almost completely eliminated. The shape of this contour was determined by the use of SR-4 strain gages. It can be readily appreciated that such contouring is only practical in a cast shaft as it is almost impossible to machine such a contour economically.

Determining Shape

Damping Capacity: Under dynamic operation many failures of parts are caused by the surge of vibration that may be set up in the piece due to the dynamic forces. This is amply brought out in the critical vibration experienced in crankshafts in internal combustion engines. This critical vibration can—and does, at times—break parts in operation.

Gray iron has excellent damping capacity. The lower the tensile strength of the iron, the higher the damping capacity. One of the best ways to demonstrate this capacity is to strike the casting. A steel casting will ring while cast iron will produce but a dull sound. While it is difficult to apply dampening capacity to design, it is always well to know that it is present in gray iron.

Impact and Brittleness: Gray iron is much more brittle than steel; therefore, it breaks with a brittle fracture while steel, being ductile, breaks with a ductile fracture. The standard impact tests such as Izod and Charpy show gray iron to have much lower values than steel.

However, testing things to destruction sometimes gives a false impression. We design so that the forces applied are well below the elastic limit of the material used; thus, we get no permanent deformation. If this were not so we would certainly have considerable difficulty with fits and running clearances.

Any appreciable amount of permanent deformation would no doubt be disastrous; thus, the amount of deformation we get under any impact blow which would be below that required to fracture is of importance. In many cases, the impact blow that will break cast iron will deform steel to an extent where it is useless.

This was demonstrated by taking a piece of steel and attaching to it a piece of cast iron of the same size and dimensions, as shown in Fig. 6. The steel had 91,000 psi tensile strength and the cast iron 54,000. A lever arm was attached on the cast iron, holding both pieces from twisting as illustrated, and a weight was dropped on this lever with force that the cast iron was broken. The iron shaft twisted 6 degrees before breaking, and the steel shaft—although it was not broken—twisted 35 degrees, which of course would have made it useless. However, the useable impact resistance of the cast iron was sufficient for the service intended.

Qualities of Cast Iron

Castability and Machinability: Gray iron is the most castable of all the ferrous metals. It will flow into thinner sections and usually requires small or no risers. As we go up in tensile strength, however, the castability gets less and requires more risers and an approach to the steel casting practice in molding. This is an important consideration when intricate designs are involved.

Gray iron therefore lends itself to much more complicated designs than do many of the other cast metals—a very important characteristic. As outstanding examples, take the automobile engine block and head, both masterpieces of intricate design which, safe to say, could not be practically cast in any other ferrous metal but gray iron.

Properly handled, gray iron is a very machinable material, although the lower tensile irons are much more machinable than the higher tensile materials.

Wear Resistance: In sliding friction, gray iron is outstanding, a statement amply demonstrated by the fact that practically all engine cylinders or lines are made of gray iron. However, the microstructure of the iron has a great deal to do with its wearing qualities.

The general rule is that the iron should have a random flake distribution of the graphite and a matrix that contains no free ferrite, to insure which a minimum Brinell hardness of 190 may be required. The type of microstructure shown in Fig. 1 will give good wear resistance, while the type shown in Fig. 2 will give exceedingly poor wear resistance.

Gray iron is also resistant to abrasive wear. However, if the iron is hardened by heat treating the wear resistance is sometimes increased and, in the case of very abrasive condi-

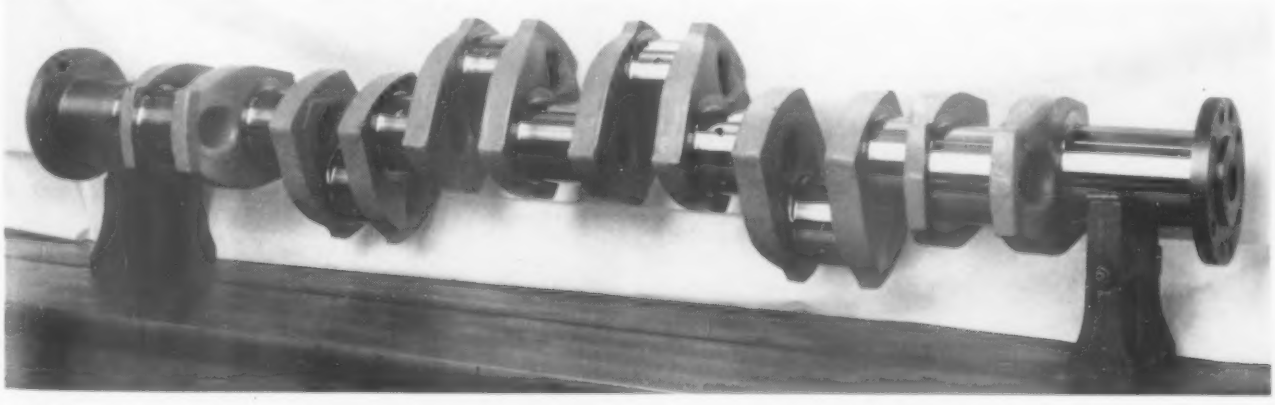


FIG. 5. A cast iron crankshaft, contoured to eliminate concentration of stresses. Tensile strength of the iron is 65,000 psi, and the shape of the contour was determined by use of SR-4 strain gages. The economy of cast iron is indcated by the contouring of the crank cheeks, which could not be practically machined at competitive costs.

tions, a white or chilled alloy cast iron—such as Ni-hard—is usually indicated.

Corrosion Resistance: Another quality of gray iron is its resistance to corrosion, demonstrated by the fact that most water mains have been made of cast iron and there are examples where these are in good condition after 100 years service. Cast iron heads, cylinder liners, and blocks in engines which are salt water cooled have been used for years with excellent success. Where more vicious conditions are encountered, however, special corrosion resistant grades are available.

Heat Resistance: While gray iron has good heat resistant qualities, this particular quality has not, as a rule, been exploited as much as it should be. Recently, however, the A.S.T.M. has developed a specification for the use of gray iron for use in pressure vessels at temperatures up to 650° F. It has been successfully used in non-pressure vessels, such as molten metal pots, for temperatures above 1200° F., but while it does a good job, it will not replace the higher alloy heat resisting steel castings where their use is actually required.

Chemical Analysis: In the foregoing discussion, chemical analysis has been mentioned quite often. To a large extent, the chemical analysis of the iron controls the physical properties of the casting chiefly because there is so little one can do to control the cooling rate of the casting in the mold. It would seem logical, therefore, that the one thing that should be specified is the chemical analysis. However, this is far from the truth—in fact, it is dangerous to do so.

The only man who is in a position to specify the proper analysis, for a given casting in which the desired physical properties are specified, is the foundry metallurgist who must make his decision after he sees the pattern or drawing, method of molding, and the gating. Thus, it is far safer to let the foundry specify its own analysis. As a matter of fact, the A.S.T.M. specifications deliberately do not specify chemical analyses. All foundrymen are perfectly willing to work to a tensile strength specification, but many will absolutely refuse to work to both tensile strength and chemical analysis.

Heat-Treatment of Gray Iron: Gray iron can be heat treated the same as steel and, by so doing, it is possible to almost double the tensile strength. This, however, involves a quench and tempering treatment and can only be applied to very simple shapes. Complicated shapes will crack during the quenching operation. Also, the increase in tensile strength by heat treatment is sometimes dangerous because it does not proportionately increase the endurance limit of the iron; therefore, one can be greatly misled when such heat treated materials are subjected to dynamic forces.

Stress Relief vs. Aging

Complicated castings of gray iron—and especially those in the range of 40,000 psi to 60,000 psi—usually have a considerable amount of residual stresses in them. Thus, they are liable to distort in subsequent machining. These stresses can very safely be removed by a stress-relief anneal, which consists of very slowly heating the casting to about 1000-1050° F., holding it there for about one hour per inch of heaviest section and cooling very slowly.

A word about the aging of gray iron castings. It has been believed, for years, that the best way to relieve casting stresses was to set the casting out in the yard for 6 months to a year. What actually happens, however, is that the surface rusts sufficiently to remove some of the metal, thus relieving the stresses. It is a much more economical, and much better practice, to give the castings a stress-relief anneal.

Gray iron can also be hardened, by quenching and drawing, to a maximum hardness of about 550-600 Brinell. This

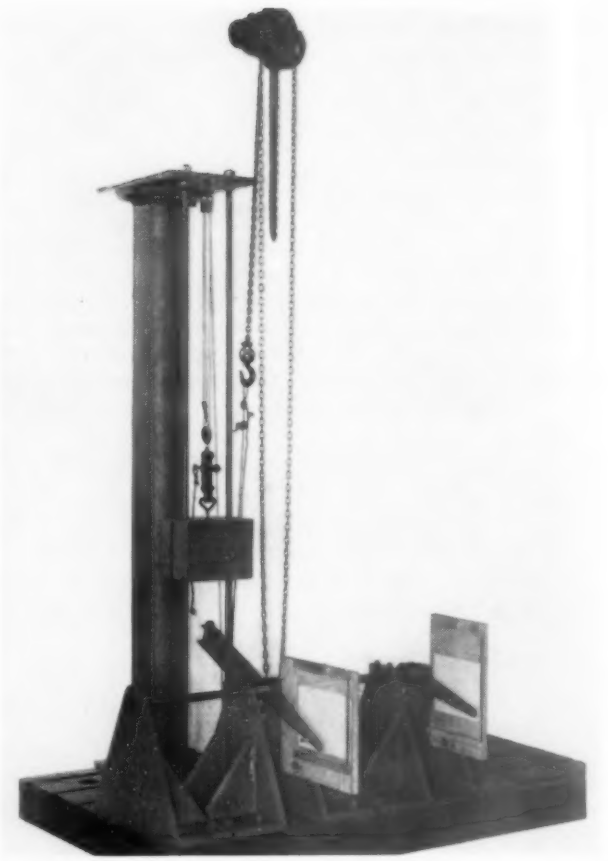


FIG. 6. Setup for a comparative torsion test on steel and cast iron. A cast iron bar (at left) was joined to a steel bar (at right) of the same size, and a lever arm was attached to the cast iron bar to hold both pieces from twisting. A weight was then dropped with such force that the iron test piece broke. However, the cast iron bar twisted 6° before breaking, while the steel bar was not broken but twisted 35°, making it useless.

hardening treatment is of great value for certain services. As, for example, in the case of Diesel engine liners and certain dies, or where abrasive wear is encountered, as on the ways of lathes and machine tools. Any of the usual methods of hardening can be employed, plus austempering, martempering, flame hardening, or induction hardening.

Some use is made of a direct annealing process on certain pieces of gray iron to improve machinability. Annealing definitely lowers the physical properties of the casting and should not be used unless these physical properties are of no consequence. The writer personally deplores the idea of annealing castings, believing that it could be avoided in most cases by proper foundry practice. It is an unnecessary expense. However, this is not true for castings made by the permanent mold process.

The principles of good casting design are the same for steel, cast iron, or the non-ferrous metals. In general, the things to avoid may be briefly covered by stating that the sections of the castings should be as uniform in thickness as possible, with ample fillets allowed in corners. Any major change in section should be taper blended instead of filleted, and the casting should be so designed that it can be divided into two halves without having an irregular parting line. Design should be such that the casting will solidify properly and, from the economical point of view, it should require the simplest possible core set-up.

In this connection, it may be suggested that the designer make up, perhaps rather roughly, the design believed to be satisfactory; then, consult a good foundryman and get his suggestions. The results may be pleasantly surprising.

By E. A. Ryder

The "How" of a Materials Handling Survey

Diversified equipment provides solution to handling problems

SELECTION OF A MATERIALS HANDLING system for a plant should be the result of a carefully planned, analytical study. As there are no simple, rule-of-thumb formulas upon which to base decision, handling problems are usually solved by a combination of the various types of systems and equipment. While it is seldom that any one type can efficiently meet all requirements, a particular system may nevertheless be chosen when it is the only one capable of doing the job. When there is a choice, however, the comparative cost per ton handled should be the deciding factor.

The material handling needs of a plant should first be thoroughly surveyed to determine the best overall system, or integration of systems; then, the equipment which best implements this system or combination of systems can be selected. Since, however, there are many important considerations, the survey should be entrusted only to informed and experienced specialists. And because their knowledge must be supplemented by a complete understanding of resident plant conditions, and nature of product, it is desirable that a staff engineer be assigned to work with them.

Route Analysis

As a basis for survey, the following information should be compiled for each of the routes over which materials are moved:

1. Beginning, end, length, and nature of route covered, including cross traffic, alternate routes, and yard and building areas.
2. Kind and nature of materials—whether in containers, unit loads or subject to special handling.
3. Weights, dimensions, and uniformity of loads.
4. Tonnage of the materials—used to compute ton-feet per load.
5. Time required per trip.
6. Variations in the flow of materials.
7. Number of employees required to operate the materials handling equipment.
8. Handling costs—which are based on labor, power, depreciation, repair and maintenance, insurance, taxes, breakage, value of floor space, and other considerations.

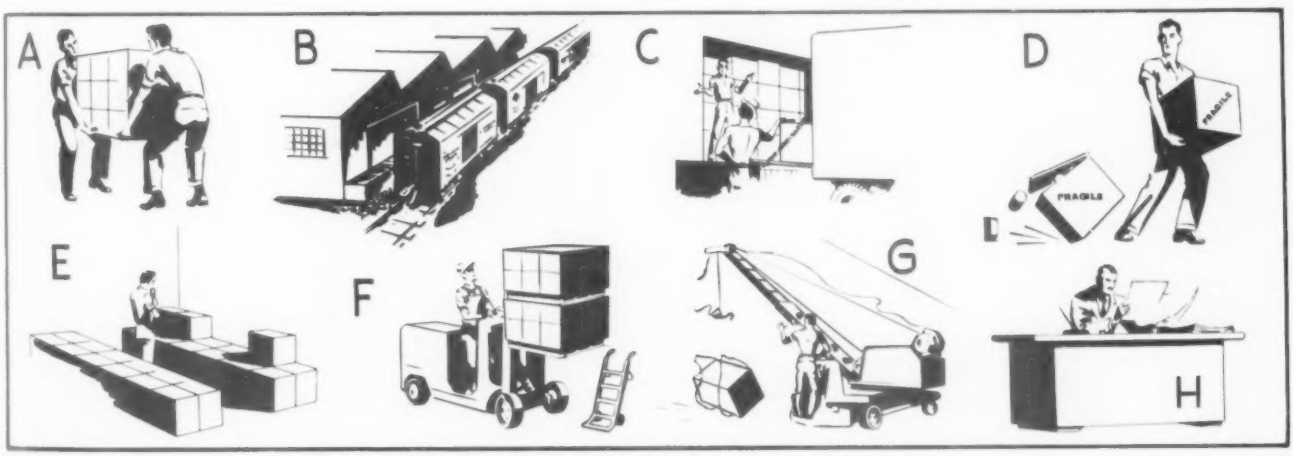
From this information, one can compare one route with another, using ton-feet as the common denominator, while the number of employees engaged can be used to compute the direct labor cost for each trip. Time per trip, and unit-load weights and dimensions, will then serve as a check on general efficiency. Points to be considered, in view of ton-feet and production needs, would be: Should trips be frequent or infrequent? Can time per trip be reduced by rerouting flow of materials? Considerations of these questions will help to decide comparative merits of manual or mechanized handling.

Where modern materials handling methods are not in general use, a survey will usually show that a considerable amount of lifting and stacking is done by hand. No time-and-motion study is needed to demonstrate the work and expense entailed by manual handling. The results are well known from previous study, and it is an accepted truism that mechanized handling is not only faster and cheaper, but reduces injury and strain on workmen, with less damage to materials being handled. It also releases workers to more productive jobs.

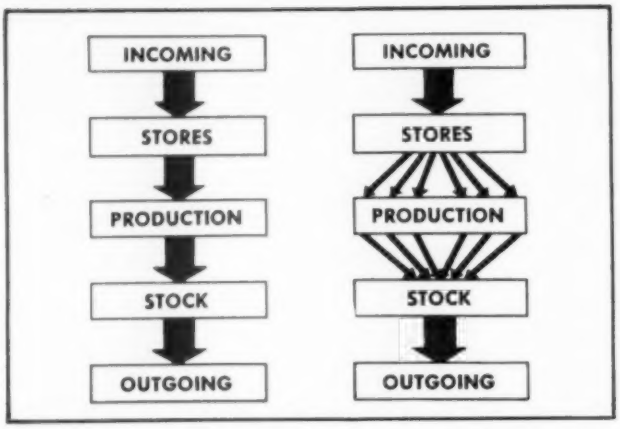
Analysis of Plant Conditions

So important is the matter of materials handling, that a system for handling should be considered when planning a building; by so anticipating future needs, the two can be fully integrated at the beginning. In the majority of cases, however, the handling system is an afterthought and designed for installation in already existing buildings. These buildings should be carefully studied before a new system of handling is decided on since, often, a mere change in route will increase the flow of goods.

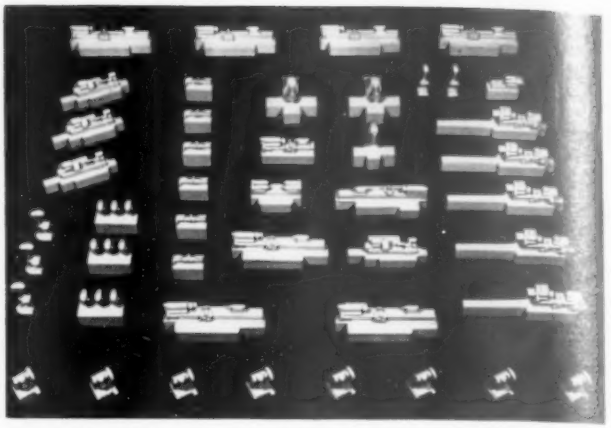
Floor bearing capacities of existing buildings must be studied to determine advisibility of using industrial trucks,



Check list of questions to be used in making a materials handling survey. (A) Are female workers manually handling materials weighing over 25 lbs., or male workers loads 40-50 lbs.? Or lifting materials from floor to overhead? Are there many 2 or 3-man lifting jobs? Can movements be shortened, or congestion relieved, by different handling methods? (B) Are incoming materials, other than bulk commodities, received in unit packages suitable for power handling? Is demurrage costing too much? (C) Is your receiving department jammed? (D) Are materials handled and stored several times before processing, with recurrent chance of damage? (E) Do the materials require special precautions because of fragility, inflammability, or danger of contamination? (F) What handling equipment do you already have? Its age and condition? Is it best adapted to the job? (G) Is your equipment causing damage to materials? Is it causing accidents? Are maintenance costs mounting? (H) What is the cost of lost time? And what proportion arises from present handling methods? What are present compensation rates, and to what extent can they be reduced by elimination of handling injuries? These, and many other questions, must be answered when making a survey.



Flow charts afford a supplementary and useful means of analyzing routes that materials follow. They can be involved, as for complex assemblies, or simple straight-line of divergent as shown in the elementary flow chart above.



Scale models, which are now to be had commercially from several sources, provide visual and clearly understandable patterns for full-scale plant and materials handling layouts. Photo by courtesy of Visual Production Planning, Inc.

powered hand trucks or floor supported conveyors. The question of increasing floor capacities should also be considered, together with breadth, smoothness and hardness of floors, since rough, uneven or soft floors give tractive resistance to all rolling equipment. Grade of ramps should be kept as low as possible since even 1% of upgrade demands 20 pounds additional tractor effort per ton. More power is also required for conveyors moving material up an incline.

Wall columns must be strong enough to support loads on jib cranes, if the cranes swing on wall brackets. Lacking this strength, equipment should be supported on a firmly anchored and braced column. Tracks of heavier equipment —such as half-portal gantries and overhead travelling cranes are, in most instances, supported by structural steel columns running up from the ground. Craneway columns are not to be obstructed by building columns or other interferences with free movement of the bridge.

New Plants should have one floor level

Load capacities of roof trusses and ceiling should be ascertained for possible direct suspension of light conveyors. When intended for greater loads, conveyors are directly suspended from a structural steel network. In addition to study of wall, floor and roof strength and capacities, the dimensions of doors, aisles, loading docks and intersections should be noted, as well as the size and tonnage of elevators. Since new entrances might be desired for trucks or conveyors, in existing walls, floor plans of all buildings should be available.

New plants should be designed with one floor level, with ramp gradients held to practical minimum as previously outlined, and elevators, if required, should have capacity for heaviest loads to be handled above or below main floor level. Columns in store and stock rooms should be spaced to facilitate efficient handling and to accommodate unit loads. Flow charts and scale charts, as well as scale models, provide means for an overall analysis of industrial methods and provide visual and clearly understandable patterns for full-scale layout.

By following logical patterns, the materials handling specialists learn about your plant, and processes, facts that are essential to proper evaluation of materials handling problems and which will result in sound suggestions for improvement. In many cases, these improvements will result from a wider use of electrical equipment.

The methods engineer can, in making a prior analysis, list facts and conditions as he finds them, on an operation-progress chart. This is any type of diagram of the operations, in sequence, which change raw material into finished product.

Equipment should be selected on a basis of fundamental characteristics of the principal mechanized systems, preferably with integration of several. For example, conveyors may be listed where loads are uniform; where materials do or can move continuously; where rate of movement, unit loads and route are not likely to vary; and where cross traffic can be by-passed by the conveyor.

Cranes and hoists may be selected for intermittent movements within a fixed area; where materials are of variable size or weight; and where material moves regardless of cross traffic or uniformity of load. Industrial trucks, including lift type, are selected where material must be picked up and moved intermittently over various routes; where materials are either of mixed or uniform size and weight; where distances are moderate and cross traffic exists, when there are suitable runways and clearances; where the operation is principally handling, and where unit loads are advantageous.

Mechanized handling is faster and cheaper than manual handling and reduces strain and injury to workers. For example, at least three men would be needed to stack the cartoned material shown being stacked in 18-ft. high tiers, by means of a lift-truck, in easy straight-line motions indicated by the arrows. Photo by courtesy of Automatic Transportation Company.

By J. W. Lengbridge

34-92000

Flow of Metal in Rectangular Draws

Installment No. 3 of a Series on the Theory and Practice of Pressing Aluminum

IN DRAWING CIRCULAR SHELLS, the ring of material held between the blankholding faces is the same width on any diameter, and the same amount of metal is moved the same distance all around the die. That is, the flow is balanced. But in drawing rectangular or unsymmetrical shells, some parts of the shell may require more severe cold work than others, and some may require more pressure to control the metal movement. The amount of flow, necessary to shape any one shell, may range from a limit draw in one section to a simple bend in another section. Likewise, the stresses induced may vary from maximum to almost zero.

A drawing operation on a rectangular shell is a typical example of a draw involving varying degrees of flow severity. In this kind of a shape, true drawing occurs only at the four corners. The sides and ends of the shell between the corner area will be compressive on the metal moving towards the die radius, and tensile in the metal which has moved over this radius, the same as in any circular draw. The stresses on the metal between the corners will be tensile only on both sidewall and flange metal.

There is, of course, no line separation of these different types of stress and flow, since they blend into each other where the corner meets the sides and ends; however, the above stress and flow conditions exist through the center of the corner radii, the center of the sides, and the ends.

Because of the unbalanced flow and the abrupt change in the contour at the corners, and also because there may be a wide variation in flow severity within a short distance, rectangular shells are usually more difficult to draw than circular shells. The operation must be carefully planned and the right amount of metal located, where needed, so as to obtain a shell of full depth all around and to eliminate unnecessary metal where the flow is severe. Since careful development of the blank size and shape is most essential, some discussion will be devoted to blank development methods in order to provide a better understanding of the flow problems involved.

Flow Areas

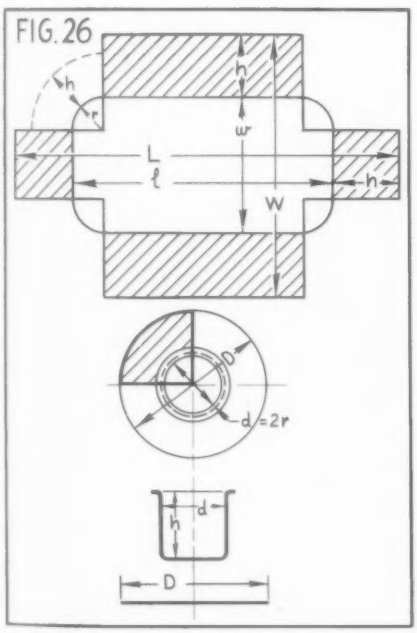
The variation in flow in different parts of a rectangular draw divides the blank into two areas (each composed of four sections):

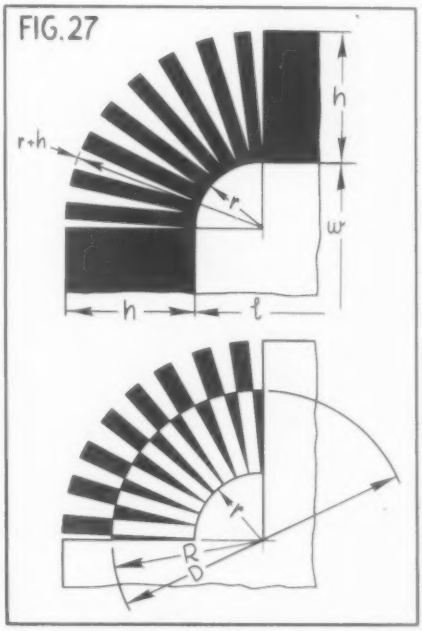
(1) The drawing area, which includes all the metal *in* the corners of the blank necessary to make a full corner on the drawn shell.

(2) The forming area, which includes all the metal *between* the corners of the blank necessary to make the sides and ends to full depth.

The above two areas are illustrated in Fig. 26, which is a development diagram of the blank for a rectangular shell having a plan view outline within the area l x w, and a corner radius of r. The shaded portion of view A is the forming area, and the shaded portion in view V is the drawing area.

The first step in the development of the blank for a rectangular shell is to draw a plan view of the shell and, since





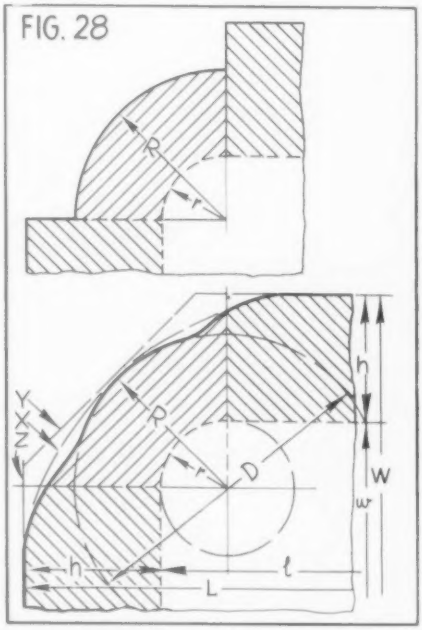


FIG. 26 shows, at A, blank development diagram for a rectangular shell having a plan view outline within the area l × w, and a corner radius of r. Distances h—or overall distances L × W—provide full depth when drawing and, while greater than distance at the corners, reduce to equal height at sides, ends, corners when drawn. The shaded portion in view A is the forming area, and that in view C—which represents metal necessary to make one corner of the shell—is the drawing area. View B shows a circular shell having a diameter d equal to 2r, and a depth of h, and this shell would require a blank having a diameter D. FIG. 27 is a schematic diagram of a rectanguar shell made without draw tools, letter symbols being same as for Fig. 26. The blank would be cut with star corners, as shown at A. By removing metal from the outer ends to fill the spaces between, as shown at B, there would be produced a solid corner on the blank having the same area as the star strips. The corners of the theoretical blank would look like view A, FIG. 28, and blending may be done as shown by the cross-hatched area in view B. X and Y show radiused and straight shear. Corners sheared as at Z will give trouble in drawing.

the sides and ends involve forming only, to lay out the overall length and width of the blank by adding twice the height to the shell outline. This distance (h) is sufficient to give full depth when formed up. Because the corners of the shell involve the same flow phenomena as any circular shell, they must be treated as such in the blank development. In other words, the metal requirements must be calculated on the assumption that each corner is a circular shell.

View B shows a circular shell having a diameter d equal to 2r, and a depth of h, and this shell would require a blank having a diameter D. View C shows a plan view of this shell and blank with a shaded portion representing the metal necessary to make one quarter of the shell, or in other words, one corner of the rectangular shell. This quarter section of the corner blank is laid out on the rectangular blank, as shown by the dotted line in view A, and the two areas are then blended together.

It is important to note that the distance h on the sides and ends is greater than h on the corners; yet, when the shell is drawn, the height at the sides, ends, and the corners will be the same. The reason, of course, is that there is sufficient metal in the area between the dotted quarter circle and the radius to draw a quarter cup shape with a radius of r, and a depth of h, so that when the sides are bent to shape, and the corners are drawn to shape, the depth will be the same in the corners and the sides.

Explained by Star Strips

The reason for this difference between the metal allowance on the corners of the blank, and the allowance on the ends and sides for the side walls of the shell, may perhaps be more fully understood by a star strip diagram. Thus, if we were faced with the problem of making a rectangular shell without the aid of draw tools, we could cut a blank with star corners as shown at A in Fig. 27, bend the side walls and star strips over a block, and obtain a rectangular shell with a radiused corner. The star strips would meet when formed, and the shell would have a depth of h on the sides, ends, and corners.

If we remove sufficient material from the outer ends of the star strips on the blank to fill the spaces in between them—as shown at B—we would produce a solid corner on the blank having the same area as the star strips which, when drawn, should produce a corner the same depth as the star strip corner. The full corner of the blank would have a radius of R, and 2R would be the diameter of a round blank necessary to draw this corner cup to a depth of h.

The corners of the theoretical blank would then look like sketch A, Fig. 28. This sharp change in the shape of the blank, where drawing ends and forming begins, is of course impractical because we cannot produce a line separation of the two kinds of flow. However, the outline of these two areas may be blended to produce a practical blank shape which can be drawn.

This blending may be done as shown by the cross hatched area in view B, or by a radius as shown by line X, or by a straight sheared corner as shown by line Y. In some cases, the blending will actually add a little metal to the corner area, stealing a little from the side and end area; however, a study of marked blanks and shells of a rectangular draw will show that some corner material actually flows into the adjacent side and end areas, thus equalizing the metal supply at these points and producing a full depth shell.

The careful development just described is not always necessary, but it does provide the right amount of metal in the corner and reduces to a minimum the amount of metal which must be made to flow. This becomes very important in cases in which the radius of the shell corner is small in relation to the depth of the shell, or where the material is thin in comparison with the blank size. If the draw is not difficult, either shear line X or Y may be quite satisfactory; however, corners similar to Z on the blank will usually appear on the shell as high ears, and these may give trouble in trimming.

In the foregoing, it has been explained how and why the blank for a rectangular shell is shaped at the corners. Fig. 29 shows a developed blank marked into area units with a shell drawn from a similar blank, the change in the area unit boundaries indicating the flow occurring in various parts of the shell. The bend areas are marked with square area units, and the flow areas are marked with radial lines and concentric circles similar to what we used for some of the circular shells. The change which is shown in the area boundaries suggests that the flow in a rectangular draw has the following characteristics:

(1) *No flow occurs on the bottom of the shell.*
(2) *Little or no flow occurs in the sides and ends.*
(3) *Flow occurs in the four corners.* The distortion to the circular area unit boundaries is quite definite through the center of the corner, and this distortion tapers off towards the side and end area. These lines run from the bending

FIG. 29

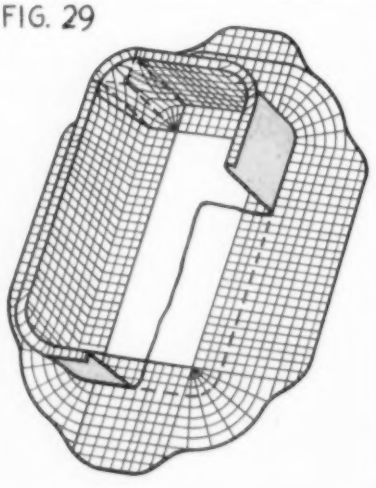


FIG. 30

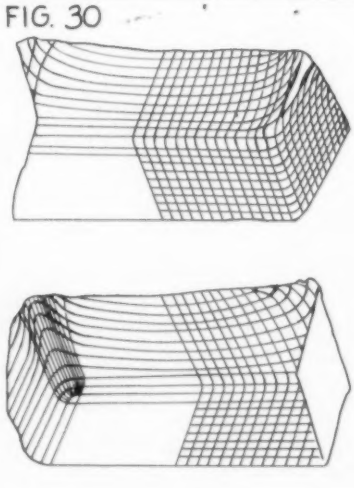


FIG. 31

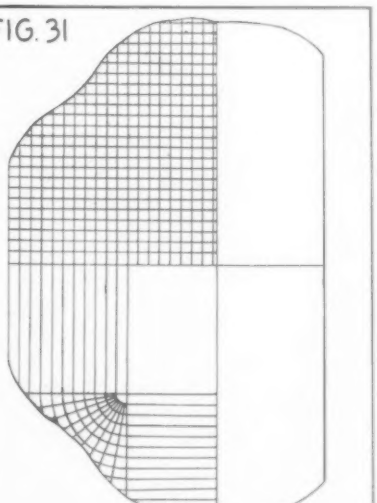
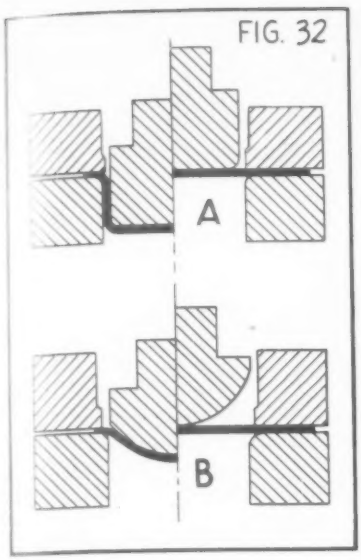


FIG. 29 shows a developed blank marked into area units with the drawn shell superimposed. The change in the area unit boundaries indicate the flow occuring in various parts of the shell. This flow is further shown in FIG. 30, in which the different markings are shown for two different corners. FIG. 31 shows the blank used for this draw, and this blank is marked with the alternate methods.



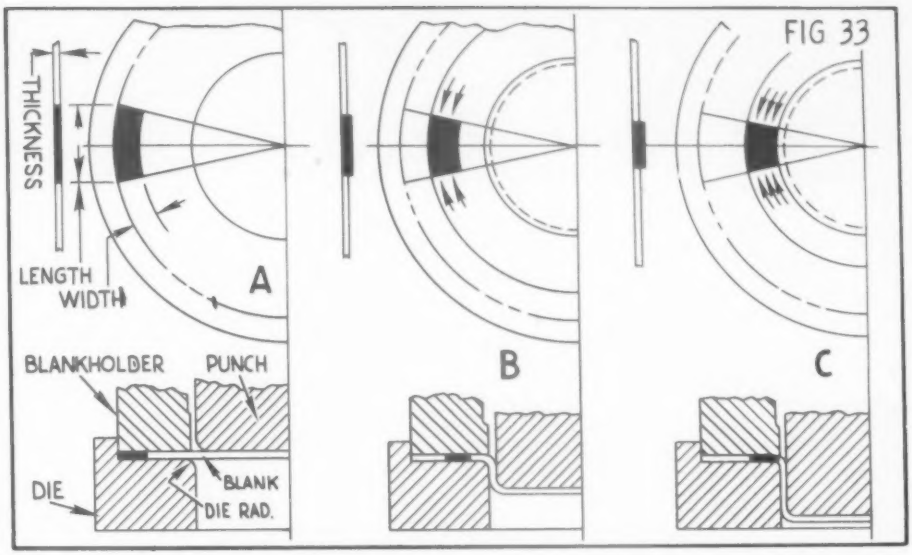


FIG. 32 shows, at A and B, two drawing methods which, respectively, produce wrinkles and puckers. In A, wrinkles may form on the metal between the blankholding faces if holding pressure is insufficient. In B, puckers would occur between point of punch contact and die radius if insufficient pressure is applied between the blankholding faces to make the metal pull tightly to the punch contour. FIG. 33 shows, in three views, the movement of a unit of area from its original position at the edge of the blank to its new position close to the top radius of the drawn shell. The marked area unit at A is confined between two radial lines. Flow indicated by the change in the position of this unit must take place within these radial boundaries, as shown in views B and C.

zone, through a zone where bending and drawing take place, and into a zone where severe drawing is done.

(4) *Some metal flows from the corner area into the side and end area.* The corner area boundaries, which were radial on the blank, now lean towards the side and end area, and the vertical lines adjacent to the corner area also lean in the same direction, indicating metal movement in a direction away from the corner.

The flow in an actual rectangular draw is shown in Fig. 30 for which two methods of marking were used in two different corners. Both tell the same story, viz: severe flow in the corners, some flow from the corner area to sides and ends, little or no flow in the sides and ends, and no flow in the bottom area. The flow from the corner area toward the side and end area (the metal movement of which we stated earlier) equalized the height where these areas on the blank outline were blended. Fig. 31 shows the blank used for this draw, and the two methods of marking are clearly shown.

The movement of metal, as described above, is typical of that which occurs in any rectangular draw. In a shell which has quite sharp corners, the movement would be more severe than one in which the corner radii were liberal in proportion to the depth and contour.

Flow Retarding Factors

From the foregoing discussion of flow in circular and rectangular shells, both occurring under severe stress and friction, it becomes evident that shaping a shell by drawing necessitates severe plastic working of the metal; therefore, any conditions or factors which retard the flow should be eliminated in order to minimize the stresses to which the metal is subjected. Some of the conditions which tend to retard the flow are as follows:

(1) *Wrinkle formation.* The formation of wrinkles in the flow area stiffens the metal by the ribbing effect, and makes flow difficult.

(2) *Excessive blankholding pressure.* The initial pressure applied to a blank at the beginning of a draw should be only sufficient to prevent wrinkle formation. Some thickening will occur with the flow, and if this thickening fills up the space between the blankholding faces the metal may be held too tightly to permit flow to take place. Hence, the blankholding pressure must be sufficient to prevent wrinkles, and yet not enough to cause pinching which would interfere with flow.

(3) *Excessive diameter reduction.* The reduction in diameter is a measure of the cold work being done on the metal, and this reduction is limited by the capacity of the metal to undergo plastic change. It must be such that the area under compressive stress is reasonably proportional to the area under tensile stress. When the ratio of the blank diameter to the shell diameter (D/d) is too high, the drawing pressure necessary to overcome flow resistance in the area of maximum flow may exceed the strength of the shell.

The ratio must be considered in drawing pressure calculations, and should rarely exceed 1.8 because, the greater the area being made to flow, the greater will be the compressive stresses induced in this area, and in consequence, the greater will be the drawing pressure necessary to make the metal flow.

(4) *Insufficient or inefficient lubrication.* The lubricant must be effective under the high pressures and heat of the operation, so as to prevent metal to metal contact, and it must often remain effective through several draws on work requiring more than one operation.

(5) *Faulty die design, construction, or setting.* Such faults as inaccurate machining of the die surfaces, poorly finished surfaces, or careless die setting can seriously affect the flow of the metal. Too sharp a die radius has the same effect. These flow retarding elements may seem small but they are important and, if not eliminated, can cause trouble in even a simple draw. With a proper understanding of flow in drawing operations, however, the engineer can eliminate most of them in the design stage of the tooling and thereby save considerable last minute adjustments.

Wrinkling and Puckering

There are so many variables, affecting flow in a drawing operation, that only the simplest draws work perfectly at the first trial. Deep draws, involving maximum plastic movement, often require hours of work to eliminate all the faults when set up for the first time. It is not unusual to spend days and even weeks on deep sharp-cornered rectangular and irregularly shaped shells, in dressing dies and altering blank outlines and radii in order to insure proper flow control and

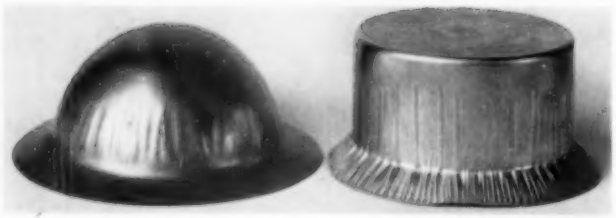


FIG. 34 shows, at right, a wrinkled shell in which the wrinkles are most severe on the flange. Wrinkles on the sidewalls were formed before that area was drawn over the die radius, and were caused by insufficient blank holding pressure. Domed shell at right is puckered, a consequence of the flow not being sufficiently retarded. It should be noted that the flange is free of puckers.

elimination of strain or fracture. This is particularly true where more than one draw is necessary.

One of the main problems in a drawing operation is the prevention of wrinkle formation, and this problem becomes more acute when drawing comparatively thin metal. There are actually two kinds of wrinkles which may be formed during the operation, and the kind most likely to occur depends somewhat on the section contour of the shell being drawn. The wrinkles may form (1) in the metal in the flow area, before it passes over the die radius, or (2) in the metal in the bottom area which does not move over the die radius.

Those in the first group are called "wrinkles" and may be controlled by increasing the blankholding pressure on the wrinkling area. Those in the second group are called "puckers," and can only be controlled by increasing the blankholding pressure on the metal outside of the puckering area. Both are the result of the compressive forces at work, and the pressure necessary to control them varies directly with the tendency of the metal to wrinkle or pucker. In general, the prevention of puckers necessitates higher blankholding pressures than the prevention of wrinkles.

The tendency of the blank to wrinkle is quite natural, because its circumference is being reduced in the process of drawing it into a cup shape, and buckling on the surface is the path of least resistance. The two drawing operations shown in Fig. 32 illustrate the contours with which wrinkles or puckers would be most likely to occur. In the operation shown at A, wrinkles may form on the metal between the blankholding faces of the tools if the blankholding pressure is not sufficient. In the operation shown at B, puckers would appear between the point of punch contact and the die radius if sufficient pressure was not applied between the blankholding faces to make the metal pull tightly to the punch contour.

Cause of Wrinkles

In any draw, the circumference of the finished shell is less than the outside circumference of the blank, and if, in the process of reducing the blank size to the shell size, the metal is free to move away from the top surface of the die, it will do so in the form of radial buckles or wrinkles.

When installing the tools and adjusting the press for an operation like that shown at A, Fig. 32, the space allowed between the two blankholding faces must be little more than the thickness of the metal being drawn. This is particularly essential when the metal is comparatively thin, the lower tendency of thick metals to wrinkle allowing more leeway in blankholder setting. The blankholder must confine the movement of the metal to a direction parallel to the die surface.

If it can rise vertically from this surface, a wrinkle will form and, because one wrinkle will tend to lift the blankholder and increase the space through which the metal is flowing, more wrinkles will form and will strengthen the ring of metal in the flow area and retard normal flow. If the load which must be applied to overcome the increased resistance to flow is greater than the strength of the metal being drawn, fractures will occur at points of weakness, such as sharp corners at the bottom of the shell, or at the top corner where the metal is being bent over the die radius.

Fig. 33 shows—in three views—the movement of a unit of area from its original position, at the edge of a blank, to its new position close to the top radius of the drawn shell. The marked unit in view A is confined between two radial lines, and the flow—indicated by the change in the position of this unit in views B and C—must take place within these radial boundaries.

As the unit moves towards the center, it is being crowded by the adjacent units, and the induced forces would cause buckling were it not for the blankholder preventing movement in a vertical direction. As the length of the unit is decreased, width and thickness are increased proportionately because the volume of the unit remains constant. The metal is free to increase in width, but the blankholder prevents a major change in thickness as well as the formation of wrinkles.

Cause of Puckers

When drawing a shell having a wide tapered or domed contour, the metal movement is more difficult to control because a portion of the area is bridging a gap and the metal is therefore free to move in any direction. Puckers will form in this free area unless the blankholding pressure is sufficient to almost prevent flow and make the metal stretch tightly over the tapered or domed contour of the punch.

The magnitude of the flow when drawing these shapes is not as great as when drawing straight-sided shells, and consequently, the compressive stresses are not as high. Because flow must be severely retarded, however, the tensile stresses are much higher in domed and tapered shapes than with straight-sided shells.

This condition often makes it quite difficult to obtain pucker-free draws on some aluminum alloys because they have not sufficient strength to withstand the high tensile stresses. Consequently, a contour which can be drawn with little difficulty on a high strength metal may be extremely difficult with aluminum, and may even involve extra operations in order to control the shaping. The problem becomes even more involved when the shell is rectangular or irregular in section.

The difference between a wrinkled shell and a puckered shell may be seen in Fig. 34. A typical wrinkled shell is shown at right, and it will be noted that the wrinkles are most severe on the flange of the shell. Any wrinkles on the sidewalls were formed before that area was drawn over the die radius.

If the blankholding pressure is not sufficient, wrinkles will form as soon as flow commences, and those closest to the die radius will be carried over to fill up die space and add ironing loads to the already increased drawing loads. When surface finish of the pressing is important—as in the case of cooking utensils—the presence of wrinkles increases finishing costs because they must be removed by subsequent lathe ironing or polishing.

The shell shown at left is domed in section, and typical of contours in which puckering would be expected if flow was not sufficiently retarded. It will be noted that the flange is quite free from wrinkles, the puckers appearing on the dome. When shells are circular in shape, puckers may be ironed out in a lathe operation, but when the shapes are irregular, rectangular, or oval, the puckers must be pressed out by bottoming the metal between the punch and die contour.

Installment No. 4 will follow in September The Tool Engineer

By Paul H. Winter

31-58110

Predetermined Speed Control of Air Cylinders

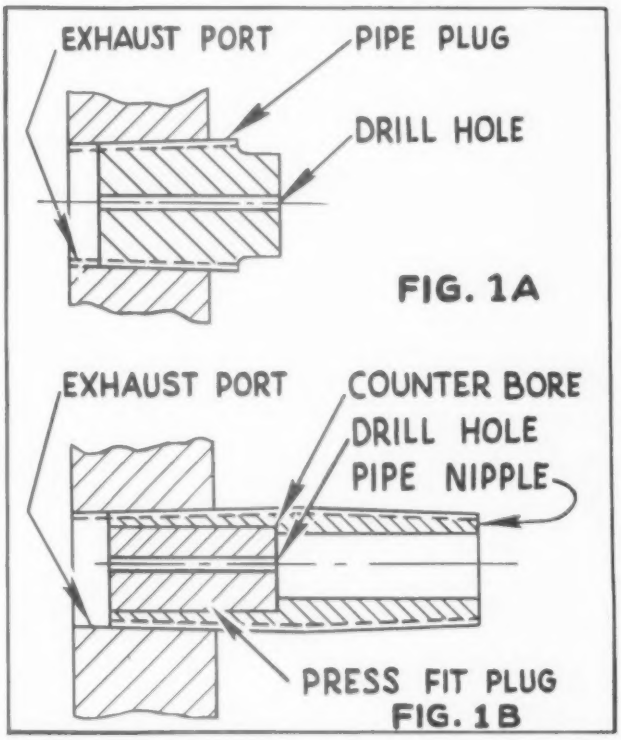
Experimental Data Bearing on Simplified Speed Control for Air Cylinders

BECAUSE THE FREE piston speed attained with full size valving and piping may be excessive, the use of air cylinders frequently requires the installation of speed controlling devices. For applications which require different adjustable speeds in service, speed control valves are available, commercially, which meter the exhaust but do not impede the inflow of air at each end of the cylinder. Metering the exhaust is the only satisfactory method of smoothly regulating the speed of piston travel, as an attempt to control the inflow will result in uneven, jerky operation.

If only one non-adjustable piston speed is required, the cheapest method of procuring it is to plug the exhaust port of the four-way valve and redrill the plug with a small hole as shown in Fig. 1A. Fig. 1B shows a design that may be used if it is desired to pipe the exhaust away from the valve. However, some pilot operated valves exhaust the air from their pilot circuits through the same port as the cylinder circuit, in which event the above method is not recommended. For all other valves it is eminently satisfactory.

There are, of course, a number of ways to obtain speed adjustments, as for example with needle valves or metering pins such as are used in cushioned cylinders, and such devices could even be incorporated in the plugs showns in Figs. 1A and 1B. But while cushions serve a useful purpose in arresting piston travel at the end of a stroke, to prevent shock, they do not provide for constancy of motion.

Thus, a piston will start slowly and accelerate during the stroke; will then decelerate and come to a comparatively slow stop. This, however, is not speed control in the sense implied in this article, which deals primarily with sustained or maintained speed of piston travel during long production runs. And for such purposes the drilled hole has been found eminently satisfactory.



Plugging the exhaust part of a 4-way valve, and redrilling a small hole as shown in Fig. 1A is the most economical means of procuring a non-adjustable piston speed on air cylinders. If it is desired to pipe the exhaust away from the valve then screw in a pipe nipple which has been previously plugged and redrilled as shown in Fig. 1B

Data Supersedes Cut-and-Try

The writer had controlled piston speeds of single purpose fixed speed machines in the manner described—*i.e.*, as for Figs. 1A and 1B—for some time when he decided to establish some empirical, experimental data to eliminate the cut-and-try procedure required to determine the correct drill hole size for each given cylinder size and desired piston speed. Since air, as a compressible medium, does not admit of extremely accurate control with any device, it was not considered necessary to work to a very close limit of accuracy in these tests.

Travel time of pistons was therefore established by means of visual observation and a stop watch graduated in .1 seconds. Three different bore sizes of double acting cylinders all with 6″ stroke) were used, and readings were taken of the travel time of the piston in both directions for different hole sizes drilled into the exhaust plugs and with line pressures of 30, 50 and 70 psi.

The tabulations shown in Fig. 2 resulted. Transforming the time of travel of the 6″ stroke piston to inches-per-minute speed, we obtain the values shown in Fig. 3. It will be noted that there is very little change in speed with a change in line pressure, so for practical purposes—and also for the commonly used shop line pressures—it will be sufficiently accurate to take the mean piston speed as shown in the last column of Fig. 3.

We now tabulate the ratio of cross sectional area of the exhaust opening in the cylinder end from which exhaust takes place to cross sectional area of the hole drilled in the exhaust plug. Multiplying the resulting value of this ratio with its corresponding piston speed, we obtain a numerical value which varies from a minimum of 293000 to a maximum of 511000. See Fig. 4.

Considering the widely varied conditions that prevailed for the different readings, and further allowing for experimental errors, we are justified in considering this numerical value a constant. In order to obtain its true value, the 30

FIGURE 2: Time Required for Full Piston Stroke and Varying Cylinder Bores and Exhaust Hole Diameters

(a) 2 inch dia. bore × 6 inch stroke × ¾ inch dia. piston rod

Hole dia. of exhaust	Air Pressure 30 p.s.i.		Air Pressure 50 p.s.i.		Air Pressure 70 p.s.i.	
	Air in at rod end	Air in at head end	Air in at rod end	Air in at head end	Air in at rod end	Air in at head end
.040 inch	2.4 secs	2.0 secs	2.4 secs	2.0 secs	2.3 secs	1.9 secs
.055	1.4	1.1	1.3	1.0	1.3	1.0
.0785	.8	.5	.8	.5	.7	.4
.096	.5	.4	.4	.3	.4	.3
.110	.3	.2	.3	.2	.3	.2

(b) 3 inch dia. bore × 6 inch stroke × 1 inch dia. piston rod

.040 inch	5.2 secs	4.2 secs	5.2 secs	4.2 secs	5.1 secs	4.1 secs
.055	3.8	3.1	3.6	3.0	3.4	2.5
.0785	1.6	1.2	1.5	1.1	1.5	1.1
.096	1.0	.7	1.0	.7	1.0	.7
.110	.8	.5	.8	.5	.8	.5

(c) 5 inch dia. bore × 6 inch stroke × 1 inch dia. piston rod

.040 inch	14.0 secs	13.0 secs	13.6 secs	12.5 secs	13.5 secs	12.3 secs
.055	8.1	7.5	8.0	7.4	7.8	7.3
.0785	4.0	3.8	3.9	3.7	3.6	3.5
.096	2.5	2.4	2.4	2.3	2.3	2.2
.110	1.8	1.6	1.8	1.6	1.8	1.6

results are added and then divided by 30 to produce an arithmetic mean of 395000.

If the piston speed = V inches per minute, piston diameter = D_1 inches, piston rod diameter = D_2 inches (0 when considering the cylinder head end), and drill hole diameter = d inches, then, the ratio of cross sectional area of the cylinder end (from which exhaust takes place) to cross sectional area of the hole in the exhaust plug is: $= 4\pi(D_1^2 - D^2_2)/4\pi d^2$ which, cancelling out the common 4π factor, may be expressed as: $(D_1^2 - D_2^2)/d^2$. From the above experimental data this ratio, multiplied by V, is equal to 395000 so that we obtain the equation: $V \times (D_1^2 - D_2^2)/d^2 = 395000$.

This is not a very convenient form to use when it is required to calculate the exhaust hole size for a given piston speed; so, by dividing both sides of the equation by 395000 and multiplying them by d^2 we obtain: $d^2 = V \times (D_1^2 - D_2^2)/395000$ and, on taking the square root, this equation is simplified to $d = .0016\sqrt{V(D_1^2 - D_2^2)}$

Example: Cylinder 5" diameter bore, 1" diameter piston rod, required speed 80" per minute for piston moving out of cylinder. Since the end of the cylinder from which exhaust takes place contains the piston rod, we must use the value given for the piston rod diameter so that we have:

$d = .0016\sqrt{80(25-1)} = .0016\sqrt{1920} = .070"$

FIGURE 3: Piston Velocity in Inches Per Minute for Full Piston Stroke and Varying Cylinder Bores and Exhaust Hole Crossectional Areas

(a) 2 inch dia. bore × 6 inch stroke × ¾ inch dia. piston rod

Hole Area	30 p.s.i.		50 p.s.i.		70 p.s.i.		Average	
	Air in rod end	Air in head end	Air in rod end	Air in head end	Air in rod end	Air in head end	Air in rod end	Air in head end
.00126	150	180	150	180	156	190	152	183
.00228	257	328	277	360	277	360	270	350
.00483	450	720	450	720	515	900	470	780
.00722	720	900	900	1200	900	1200	840	1100
.00949	1200	1800	1200	1800	1200	1800	1200	1800

(b) 3 inch dia. bore × 6 inch stroke × 1 inch dia. piston rod

.00126	69	86	69	86	70	88	70	87
.00228	95	116	100	128	105	144	100	130
.00483	225	300	240	328	240	328	232	320
.00722	360	515	360	515	360	515	360	515
.00949	450	720	450	720	450	720	450	720

(c) 5 inch dia. bore × 6 inch stroke × ¾ inch dia. piston rod

.00126	26	28	26	29	27	29	26	29
.00228	45	48	45	48	46	49	45	48
.00483	90	95	92	97	100	103	96	100
.00722	144	150	150	157	157	164	150	154
.00949	200	225	200	225	200	225	200	225

FIGURE 4: Product of Ratio of Area of Exhaust Port to Area of Exhaust Hole and in Plug and Average Velocity of Piston in Inches Per Minute for Varying Exhaust Hole Diameters

(a) 2 inch dia. bore × 6 inch stroke × ¾ inch dia. piston rod.
Area at head end 3.14 sq. inch; area at rod end 2.7 sq. inch

Air admitted at rod end			Air admitted at head end		
Ratio of Areas	Velocity	Ratio Velocity	Ratio of Areas	Velocity	Ratio Velocity
3.14/.00126=2490	150	373000	2.7/.00126=2130	185	384000
3.14/.00228=1375	257	351000	2.7/.00228=1182	350	413000
3.14/.00483=650	450	293000	2.7/.00483=558	780	435000
3.14/.00722=435	720	313000	2.7/.00722=374	1100	411000
3.14/.00949=332	1200	398000	2.7/.00949=285	1800	511000
(b) 3 inch dia. bore × 6 inch stroke × 1 inch dia. piston rod Area at head end 7.08 sq. inch; area at rod end 6.3 sq. inch					
7.08/.00126=5910	70	413000	6.3/.00126=5230	87	455000
7.08/.00228=3140	100	314000	6.3/.00228=2760	130	358000
7.08/.00483=1455	232	337000	6.3/.00483=1300	320	415000
7.08/.00722=985	360	354000	6.3/.00722=851	515	439000
7.08/.00949=745	450	335000	6.3/.00949=664	720	477000
(c) 5 inch dia. bore × 6 inch stroke × 1 inch dia. piston rod Area at head end 19.64 sq. inch; area at rod end 18.86 sq. inch					
19.64/.00126=15600	26	405000	18.86/.00126=15000	29	435000
19.64/.00228=8620	45	388000	18.86/.00228=8280	48	397000
19.64/.00483=4065	96	390000	18.86/.00483=3910	100	391000
19.64/.00722=2720	150	406000	18.86/.00722=2610	154	402000
19.64/.00949=2070	200	414000	18.86/.00949=1980	225	445000

It must be remembered that once a hole size has been determined for a given piston speed in one direction, the speed in the other direction is automatically determined and can be calculated by substituting the known values in the above equation. For our assumed set of values on the return stroke of the piston, exhaust will take place from the end that does not contain the piston rod so that our equation becomes $.070 = .0016\sqrt{V \times 25}$ or, $25V = 1910$ or, $V = 76.5$" per minute return stroke speed.

This will show (as will also be noted from the test results, Figs. 2 and 3) that the piston will move faster toward the rod end than to the head end of the cylinder.

After establishing these formulae, the writer has had occasion to apply them in practice and has found them amply accurate for the uses air cylinders are put to. Their application has eliminated a great deal of experimental and guess work on a number of single purpose machines.

Scrap Drive Helps To Solve Steel Shortage

One idea, that would go a long way to relieve the steel shortage was tried out with remarkable success by the Gear Grinding Machine Company of Detroit. The company awarded prizes of United States Savings Bonds to employees bringing in the greatest amount of scrap. As a result, nearly 23 tons were collected and put back into circulation. The scrap was sold to established dealers and the entire proceeds of the sale were given to the American Red Cross. As the collection of scrap is vital, it may be suggested that other companies may well follow the "Gear-grind Plan."

By John A. Markstrum

34-9 000

Fundamentals of Broaching

A broach is a cutting tool that roughs, semi-finishes and finishes in one pass.

EVERY SUCCESSFUL BROACHING APPLICATION, from the simplest to the most complex, must adhere strictly to basic principles. Turning, milling, shaping, drilling and reaming may, to a considerable extent, be governed by the skill of the operator to attain good results. But in broaching, the skill must be incorporated in the broach itself. In other words, the best operator is unable to produce good parts with an improper broach, whereas a semi-skilled operator can mass-produce precision work with a good broach properly designed and properly applied.

It may therefore be logically deduced that, since all operations including inspection are governed by the broach print, the most important single step in making a broach is the design. Design must be based on the actual problem and with all conditions known; that is, the material to be cut, length of surface to be cut, amount of stock to be removed, and the make, style, power and stroke of the machine to be used. This information is not only necessary for design but for cost estimating—the latter a first consideration on a prospective order.

John A. Markstrum **is widely experienced in broaching and cutting tool design and applications. For many years Chief Engineer at Continental Tool Works, division of Ex-Cell-O Corp'n, he is now Consulting Engineer with Apex Broach Company, Detroit. He is a member of Detroit Chapter, ASTE, and past Director of the Society.**

Reasons why all this information is required will be shown below; the point we want to make here is that a broach designed for one set of conditions may be and usually is entirely unsuited for another set of conditions even though the cross section shape may be identical. Without knowing all conditions, a broach engineer can no more design a broach that will work than a doctor can prescribe a remedy for a patient without first diagnosing the illness.

With these preliminaries, we will proceed to show what makes a broach tick. A full treatise on broach design is, of course, beyond the scope of this article which, in the main, will be confined to fundamentals largely based on questions and answers, from user to vendor, over a period of years. The text covers general conditions but allows for variations which may be possible under favorable conditions.

Definitions, Purposes and Classifications

A broach is a cutting tool in the form of a bar, as shown in Fig. 1. Transverse notches form teeth which increase progressively in height toward the rear end. It is pulled or pushed lengthwise, through or across the work, reproducing the contour of its cutting teeth.

The purpose of a broach is to remove stock rapidly; to produce duplicate parts to close limits of tolerances; and to produce parts—such as those with internal form—not readily processed by any other tool or method.

There are two general classifications:—hole broaches and surface broaches. The former, or internal broach, is older and more universally known, while the latter, or external broach, has had its greatest development within the past two decades. Internal broaches are usually made in one piece; on large types, however, inserts may be held in a bar or holder, such as standardized and adopted by the Broaching Tool Institute. See Fig. 2.

Sometimes, finishing shells are mounted at the end of large round or spline broaches, or, the entire cutting section may be in the form of shells when proportions warrant such construction. Surface broaches, on the other hand, are mainly of the insert type, except when the section is so small as to prevent introduction of inserts. Taper gibs are frequently introduced between holder and inserts to form ready and accurate adjustment.

Broach Compared to Cutter

It may be interesting to compare a cutter to a broach in design and operation. Both are intended to remove stock and to produce smooth and accurate surfaces. A cutter is a rotating tool, and each of its teeth finish a small portion of the surface. Each tooth on a cutter engages the work for a relatively short time, and then runs into space to dispose of the short chip and to be cooled.

In a broach, only the last few teeth produce the finished surface; yet, each tooth cuts a chip the full length of the work. Therefore, it is obvious that the size and contour of the chip space is of utmost importance for successful broach performance. The front face and fillet at the bottom must be designed to curl the chip into its smallest form—a compact spiral. A chip of this nature will not clog and, in addition, requires shorter tooth spacing and consequently permits making the broach shorter and therefore less ex-

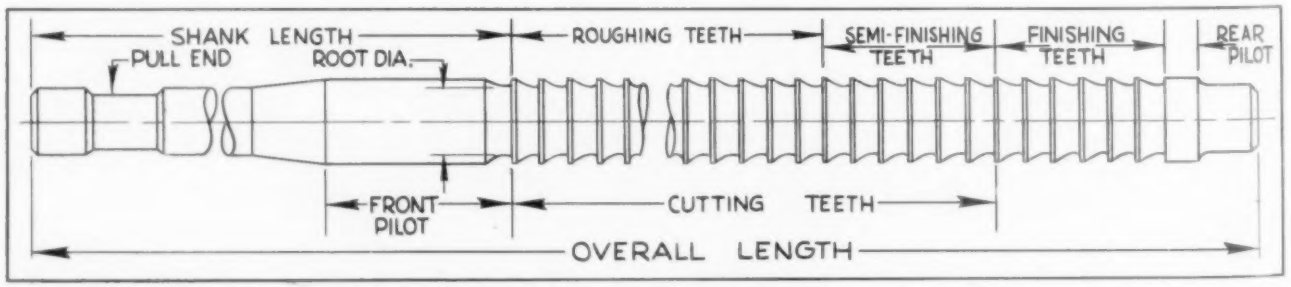


FIG. 1, a typical internal round broach with various sections defined. The follow-rest grip, not designated, is immediately behind the rear pilot.

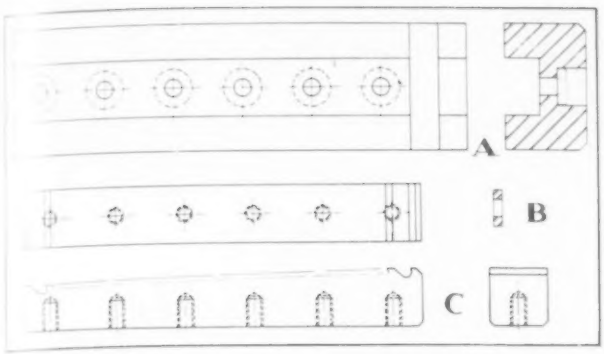


FIG. 2. Standardized broach holders (A) and inserts (B) as adopted by the Broaching Tool Institute. Standardized washers are shown at C. These holder-insert combinations are made to take screws from No. 8 to ¾", with washers ranging from 1/16" to ¼" thick and from 7/16" to 1½" O. D. Hole spacings are made to suit inserts.

pensive. See Fig. 3, A and C. Wrong tooth forms are shown at B, Fig. 3.

Speeds and Feeds

While cutters can travel at comparatively high peripheral speeds, broaches, with a few exceptions, reach their maximum speed at about 30 feet per minute. In general, the speed of a broach is approximately one-third that of a cutter for a given material. Yet, the broach is the fastest stock-removing precision tool known today.

The feed of a cutter can be controlled by the operator by changing the feed ratios in the machine, while the broach has its feed embodied in itself and therefore is not variable. This fact puts the responsibility of feed entirely on the

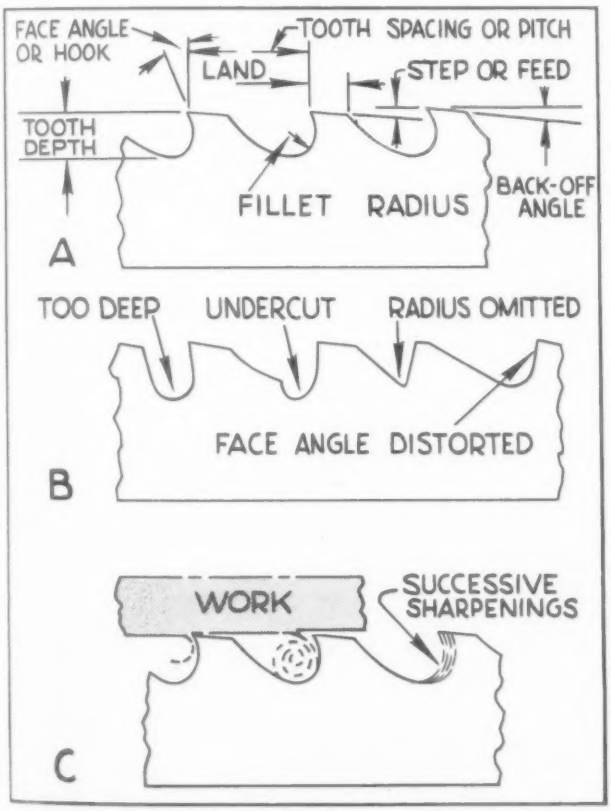


FIG. 3, at A, shows terminology of tooth form, with wrong tooth forms indicated in B. C shows how a steel chip curls into a compact spiral. Cast iron and brass produce crumbled chips. General rules for hook and back-off, as indicated in A, are: For steel, hook angle is 10°-15°, back-off angle ½°-2°; for cast iron, hook angle is 4°-10°, back-off angle 2°-5°; for bronze and brass, angles are 0°-5° and ¼°-½° for hook and back-off, respectively. Successive sharpenings must follow original contour of fillet radius.

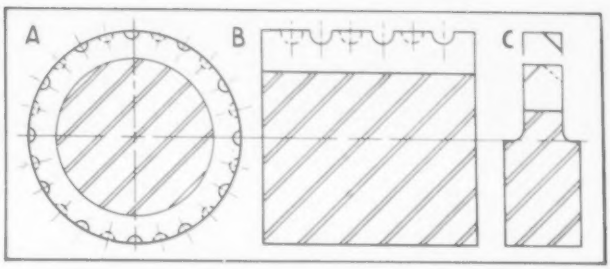


FIG. 4, A, B, and C, show chip breakers on round, flat and slotting broaches. Chip breakers on roughing teeth only; finish teeth are not nicked or relieved. On a round broach, chip breakers are staggered on alternate teeth, and progressively staggered on flat broaches. On slotting broaches, alternate teeth are bevelled as shown.

broach designer as very little variation in feed—that is, step per tooth—can be effected once a broach is completed. The only variation possible is to increase the step per tooth, and this is seldom desirable.

Decreasing the step per tooth means that the finish end will be undersize, and that another broach would need to be introduced to remove the remaining stock. This is not a common occurence, but is used here to illustrate how fixed the feed is on a broach.

To relieve the strain on broaches, and also to break up wide chip curls—and especially in round broaches—chip breakers are incorporated as shown in Fig 4 at A, B and C. These chip breakers are staggered on successive teeth but omitted on the finishing teeth.

Length of Broach

The length of a broach is determined by the length of surface to be machined, and the depth of cut or amount of stock to be removed. The length of the cut determines the tooth spacing, and the depth of cut the number of teeth. Therefore, the number of teeth, times the tooth spacing, equals the overall length of the cutting section of the broach. To this is added the length of the finishing teeth, the shank and rear pilot to obtain the overall length, all as shown in Fig. 1.

Surface Broaches

Surface broaches may be divided into four main groups:

1. Broaches guided in fixtures; they may be solid or built-up, push or pull type.
2. Broaches anchored to and propelled by a guided ram; these are always of the built-up type.
3. Slab broaches stepping straight into the work, as shown in Fig. 5.
4. Generating broaches, sometimes called the progressive type, as shown in Fig. 6. Starting at the edge of the work each tooth removes a chip in the same manner as a planer tool. This method has the advantage in that the tooth gets under the scale of castings and parts the scale in a tranverse direction tending to increase tool life. Less strain is also imparted to the work which favors parts having weak sections.

   Generating broaches should have flat finishing inserts at the rear end to improve size and finish. Form broaches, as indicated in Fig. 7, are frequently made in the generating type. Concave and convex shapes, gear tooth forms, and similar, are surface ground the full length of the toothed section. The teeth are then stepped with cutting clearance on top of the teeth only, and progressive flat chips are cut the full width of the form until the contour is completed. A few formed shaving teeth at the rear end are used when quality of finish is important.

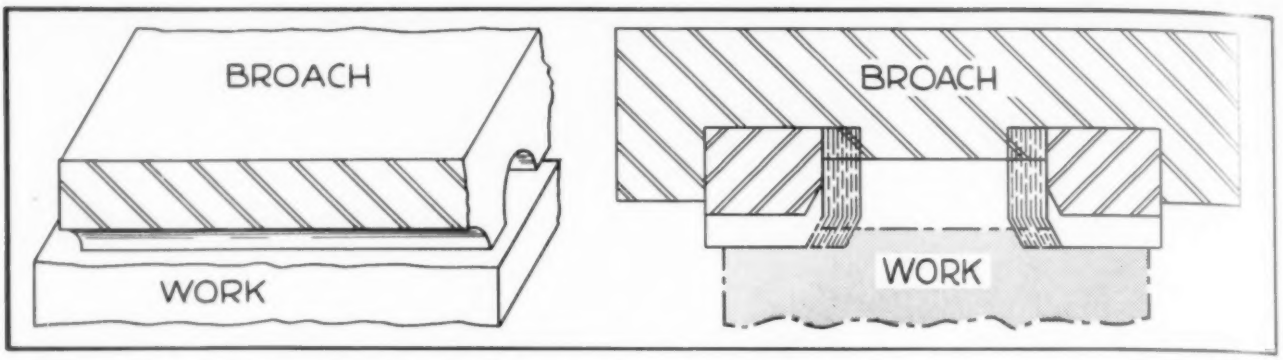


FIG. 5 shows a slab broach in section, and also a plan view of the teeth. These broaches can be made sectional and are used also for finishing passes on work previously roughed with a generating broach.

FIG. 6 shows a section of a generating broach, symmetrical on the centerline, for roughing cuts on materials having abrasive scale. The teeth cut from outside in, as indicated by the dotted lines. The last few teeth, for semi-finishing, are straight across. Both generationg form and semi-finishing teeth may be made sectional.

Cutting Lubricants

The cutting compound for broaching serves two purposes:—Cooling the work and the broach, and acting as a lubricant. It is therefore necessary to determine which of these two factors are the most essential and to select a suitable coolant accordingly.

As a general rule, the thinner the compound the more the cooling effect on the work; conversely, the thicker it is the more lubricating its nature. Soluble oil is used in many applications for steel, bronze, brass, and aluminum. For heavier work in steel, a sulphur base oil is used. Cast iron is broached either dry or with kersosene or light sulphur oil.

For burnishing steel, a heavy special oil should be used to prevent loading of the burnishers. Lighter compounds are used in burnishing brass, bronze, and aluminum. Broaches and parts should be flooded liberally with coolant to carry away heat and chips in addition to insuring proper lubrication.

Care of Broaches

Keeping a broach constantly sharp pays big dividends. A few pieces cut after teeth are dull can do more damage to the broach than hundreds of parts cut with sharp teeth. In sharpening, the original tooth form should be maintained as nearly as possible. If this is done, the last sharpening should give as many parts as the first. Avoid hard objects contacting the teeth, as nicks so formed reduce the life of the broach and will cause a round broach to drift—that is, to cut off center. A broach should be oiled and wrapped for storing.

A broach is a precision tool, and must be made to exact specifications in order to function, regardless of part tolerances. If mistreated, it refuses to work while, with ordinary care, it is one of industry's best production tools.

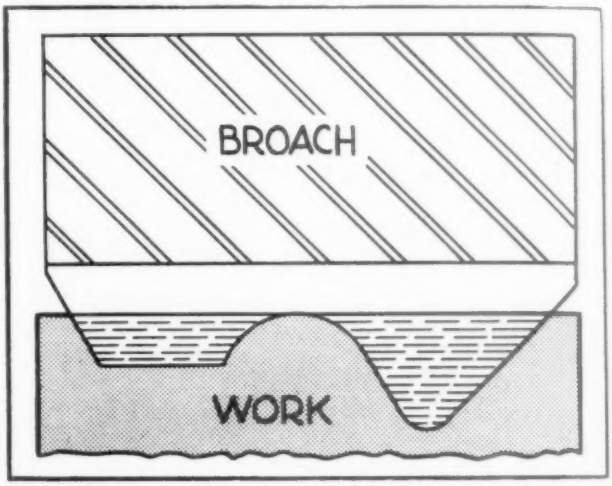
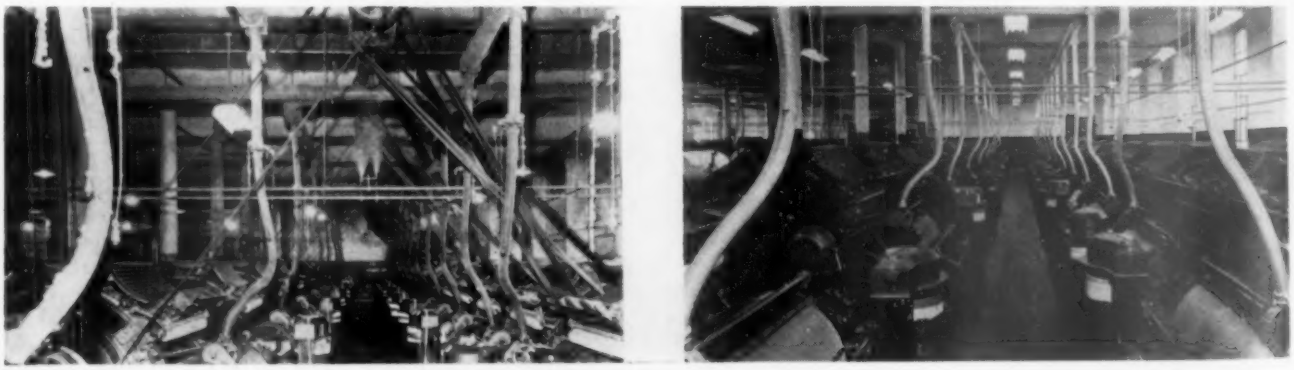


FIG. 7 is a form broach showing how teeth are generated, step by step, to produce the final contour as shown by the full-line profile. Preceding teeth are progressively higher, through the roughing range, the last few teeth being left full contour.

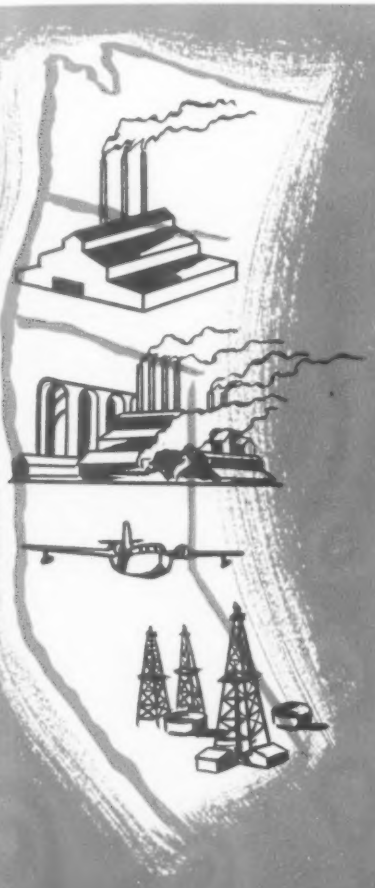
The "Before and After" of Group and Individual Motor Drive



Conversion to individual motor drive for batteries of flat-top card machines, at the Exposition Cotton Mills, Atlanta, Ga., not only eliminated shaft maintenance, belt replacements and total shutdowns because of motor failures on main-line shafts, but completely modernized the plant. The motors—General Electric 1½ HP totally enclosed, waste-packed-bearing textile mill motors—now transmit drive to each machine through silent chain. This is an excellent example of "good housekeeping" effected by individual motor drive.

A.S.T.E. Salutes

Progress ON THE Pacific

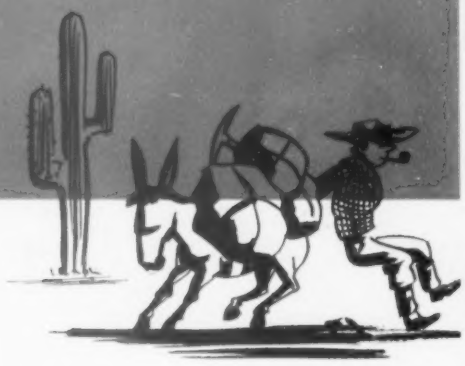


16th SEMI-ANNUAL A. S. T. E. MEETING

THE BILTMORE HOTEL

LOS ANGELES, CALIFORNIA

OCTOBER 11, 12, 13, 1948



PROGRAM • West Coast Convention • SECTION

EARL WARREN
GOVERNOR

State of California
GOVERNOR'S OFFICE
SACRAMENTO

June 5, 1948

TO THE MEMBERS OF THE
AMERICAN SOCIETY OF TOOL ENGINEERS:

It gives me great pleasure to join in welcoming you to California for your national convention. During the war and in the years which have followed, our State has undergone a tremendous industrial expansion. Because of this I know that you will find in our factories many technical processes of interest.

You have chosen to visit with us during one of California's great Centennial years. It is my hope, therefore, that while you are our guests you will also have opportunity to become better acquainted with the communities and traditions which have figured so importantly in our history, and that you will share with us in the inspiration which a review of our century of progress will bring.

With best wishes for a successful convention, I am

Sincerely,

Earl Warren
Governor

EW:aj

FLETCHER BOWRON
MAYOR

OFFICE OF THE MAYOR
CITY HALL
LOS ANGELES 12, CALIFORNIA

June 24, 1948

To
The American Society of Tool Engineers

It gives me considerable pleasure to extend a warm welcome to the American Society of Tool Engineers on the occasion of your semi-annual convention in Los Angeles, October 11 to 13.

The recent war has demonstrated beyond doubt the importance of tool engineers. Throughout the world, the superiority of American production brought victory to the Allied forces.

Today, American tools are turning out the products of peace. The energy which won victory is now being directed toward the rebuilding of a shattered world. The tool engineers of America deserve wide recognition for the great technological contributions they are making.

Los Angeles owes special thanks to the tool engineers. This city has become the second largest industrial center in America, largely through the genius of engineers who have provided the implements for this industrial expansion. On behalf of the people of Los Angeles, I extend greetings and best wishes for a successful and pleasant convention.

Sincerely yours,

Fletcher Bowron
MAYOR

FB:pd

Welcome to Los Angeles

To each member of the American Society of Tool Engineers, attending this Semi-Annual Convention, I extend a most cordial welcome.

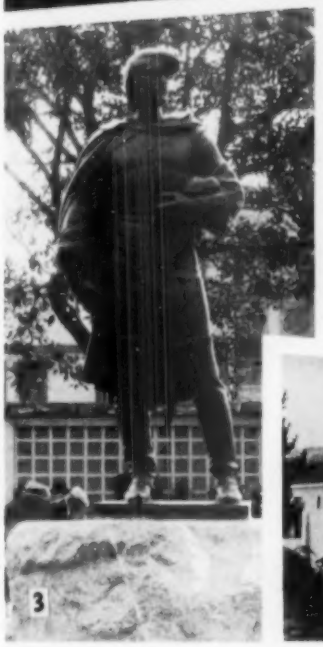
Our meeting is aptly entitled "Progress on the Pacific" for here we will discern, both in our technical sessions and plant tours, the amazing industrial development that has taken place on the West Coast in the past few years.

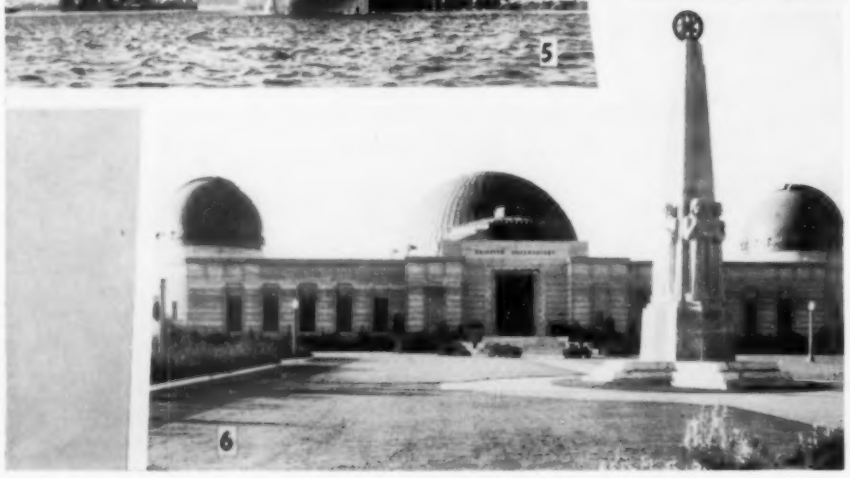
Giant modern industries, born of wartime production demands, have been converted to manufacture of consumer goods for national and export markets. In addition, there are many new branch plants of nationally-known concerns, also of interest to ASTE visitors.

Together these provide a golden opportunity for the tool engineer to observe how the latest designs and developments in tools, machines and processes have been adapted to a wide variety of operations.

Southern California is one of America's most scenic areas. I hope that you will participate fully in the program of sightseeing and social events and that this 16th Semi-Annual Meeting will be long remembered as a unique combination of pleasure and education, broadening our horizons and inspiring us with new zeal to help bring more and better things to all the world.

IRWIN F. HOLLAND, *President*
American Society of Tool Engineers





WHEN ASTE converges on Los Angeles for its 16th Semi-Annual Meeting, October 11-13, it will doff its collective hat to a great geographical area that has capitalized on climate, hurdled mountains, controlled drouth, harnessed torrents, perfected agriculture, pioneered industries, built great engineering masterpieces, and found itself a bright place in a perennial sun.

Here in a brief hundred years, the raw, struggling frontier has become an assured, self-sufficient go-getter, a pace setter in design, modes, and pattern for living.

In the spirit of the carefree, outdoor life of Southern California, much of the convention program is planned to give the visitors the benefit of the highly publicized sunshine and, simultaneously, to show them some of the equally publicized attractions.

All day Monday and Tuesday, and Wednesday afternoon there will be a varied itinerary of bus trips to modern manufacturing plants, combining sightseeing to points of interest and views of the verdant countryside. These tours are described in detail in later pages.

Monday and Tuesday evenings, the engineers will return to The Biltmore, convention headquarters, to hear how the West tools up some of its important industries.

A timely subject in an air-minded world, "Adventures in space," to be presented by Hall L. Hibbard, Vice-President and Chief Engineer, Lockheed Aircraft Corp., Burbank, Calif., will deal with principles of jet and rocket propulsion and their adaptability to either atmospheric or non-atmospheric travel.

Other phases of the discussion include

1. The festively floodlighted Biltmore Hotel will be home for ASTE members during the Society's convention at Los Angeles. 2. Typical of Pacific shore playgrounds is the five-mile municipal beach at Venice. 3. Surveying the Plaza where he founded Los Angeles, Felipe de Neve seems bewildered by the teeming city of today. 4. A Spanish type home clings to a suburban hillside, beneath the dome of Mt. Wilson observatory. 5. Salty freighters, luxury liners and mighty warships gather at the busy port of Los Angeles. 6. The universe may be contemplated from Griffith Park Planetarium and Observatory. Below: Old China and New America mingle in one of the three Chinese sections

Los Angeles

Memorable Activities Planned For All Who Attend ASTE West Coast Convention

a description of certain bodies in space, composition of atmosphere from sea level to outer space, and principles of escape from the earth, together with an explanation of reactions of the human anatomy when exposed to such conditions.

Mr. Hibbard directed the design and development of the Lightning P-38 and Shooting Star P-80 fighters and other swift aircraft. Recently, at President Truman's request, he represented the entire American aircraft manufacturing industry as advisor to the United States delegation attending the second annual assembly of the International Civil Aviation Organization at Geneva, Switzerland.

Chairman for the first meeting will be Fred J. Schmitt, First Vice-Chairman of the National Program Committee.

The engineering side of California's biggest business will be considered at the second session, a symposium entitled, "Petroleum Industry—Tooling and Refining."

"The Part Played by Controlled Directional Drilling in Today's Major Drilling Programs" will be delineated by Gordon Jackson, Vice-President and General Manager, Eastman Oil Well Survey Co., Denver, Colo.

Writer on drilling practice, designer of high pressure equipment and inventor of cementing apparatus, William D. Owsley, Technical Advisor to Halliburton Oil Well Cementing Co., Duncan, Okla., will lecture on "Oil Well Cementing."

Standards for drilling and production equipment will be treated by Hallan N. Marsh, Production Engineer, General Petroleum Corp., Los Angeles, in an address, "Oil Field Standardization." Largely endorsed without alteration, by the War Production Board, oil industry standards tend to accomplish interchangeability, economy, utility and understanding.

The field of "Exploration" and geophysical instruments involved in determining the prospects of striking oil are the theme of a talk by A. C. Rubel, Vice-President, Union Oil Company of California, Los Angeles.

Of prime interest to tool engineers, "Technical Aspects of Drilling" will be disclosed by D. S. Faulkner, Vice-President, National Supply Co., Torrance, Calif.

From a chemical engineer who helped plan and design the Ras Tanura refinery in Saudi Arabia, members will learn about "Refining." Speaker on this subject is O. N. Miller, General Manager of Manufacturing for the Standard Oil Company of California, San Francisco.

Arthur D. Lewis, Los Angeles member of the National Program Committee, will conduct this forum.

The land of make-believe will be the destination of the entire ASTE party when they set out Wednesday morning for a general tour of Hollywood motion picture lots. You may get a closeup of some "foreign" or "historical" setting you've seen on the screen, or even a glimpse of an occasional player. But movies have production schedules, too, so sound stages are off limits for visitors.

Your chances of spotting a star are much better along the sun-drenched, semi-tropical beaches which will complete the day's outing.

Gayest event of the convention will be the banquet, Wednesday evening. Holly-

Left: Though the temperature registers 80° outside, real snow and ice give a wintry setting to this sound stage. Right: Grauman's Chinese Theatre, scene of extravagant Hollywood premieres, records in permanent concrete footprints of ephemeral motion picture stars

Left: A pleasant rendezvous, the sumptuous Galeria floor of the Biltmore is scene of ASTE convention meetings. Right: From observatory atop nearby Mt. Wilson, Carnegie Institute scientists scan the heavens through a 100-inch telescope and seven smaller ones

wood's Edward Arnold is scheduled to emcee the affair and introduce the guest speaker, Kenneth T. Norris, President, Norris Stamping and Manufacturing Co.

Well fitted to air "Western Industrial Problems," the busy Los Angeles industrialist holds offices in two other companies, as well as in numerous local and national trade, civic and governmental bodies.

A top-flight floor show of outstanding talent is promised, and the festivities will end with dancing to music by Al Gayle and his orchestra, favorites with Los Angeles cafe and radio audiences.

Your wife will probably see more of the town than you do for there's a three-day program of optional activities planned especially for the ladies, outlined on another page.

Only business meeting of the convention will take place Tuesday when the Board of Directors, elected last March, assembles for the first time.

Registration for the convention covers the biggest dollar's worth of fun, travel and education available anywhere, and includes transportation for all the tours. Fee for non-members is $2.00. Banquet tickets are additional.

Few ASTE visitors will be able to shake off the spell of the host city when the convention closes; most will stay on to see more of the sprawling metropolis that mushroomed from a precarious settlement founded 167 years ago by Felipe de Neve, third Spanish Governor to California.

Inversely with its growth in size and turbulent changes in nationality, its name has shrunk. The original, pious "El Pueblo de Nuestra Senora la Reina de Los Angeles de Porciunula" became "El Pueblo de Los Angeles" in 1822 when it was "freed" as a Spanish colony, only to come under Mexican domination.

After a series of bloody hostilities, the United States took possession of "Los Angeles" in 1847. Significantly it had made little perceptible progress until the Americans made their appearance—a century ago.

Advent of the first railroad doubled its population by 1880; the rail rate wars boosted it phenomenally in the next decade. Meanwhile the citrus fruit was gaining supremacy over the Florida product. With increased agriculture, trade was begun and a harbor developed.

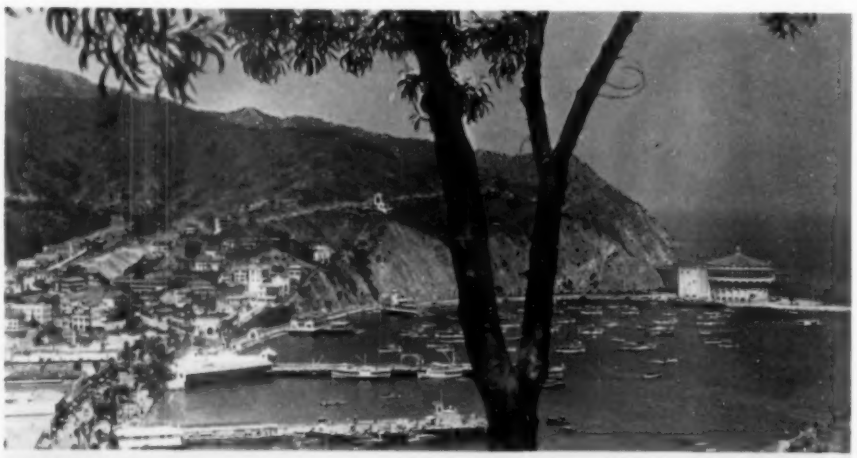
Then came the oil boom and the second major industry—motion pictures. More recently Los Angeles business and industry have expanded in all directions to serve the nearly two million local population, western and national markets.

The Plaza, hub of the quaint older section retaining the charm of Spanish-California days, marks the spot where de Neve founded the early pueblo. Across from it is the venerable, adobe "Church of Our Lady Queen of the Angels," a museum of relics and lovely paintings.

Nearby are two of the three Chinatowns, with exotic architecture, oriental shops, and Cantonese restaurants.

On picturesque Olvera Street, Mexican craftsmen dip candles, blow glass, and turn pottery, and charming dancing Senoritas wait on patrons of sidewalk cafes.

In kaleidoscopic contrast are the modern buildings of the Civic Center, tar pits holding bones of prehistoric animals, ostrich and alligator farms, flying fish, submarine gardens, a mountain-top observatory, outdoor Greek theatre and much, much more. All things to all people, Los Angeles is a city like no other.



Left: Flying fish and submarine gardens fascinate visitors to Catalina Island. Renowned conductors direct "Symphonies Under the Stars" in Hollywood Bowl

UP and DOWN THE PACIFIC COAST

WHICHEVER POINT of the compass you follow returning from Los A[illegible]les, you'll be exposed to spectacular [illegible]ry.

[illegible]torists will want to take the red-[illegible] trail through primeval forests of [illegible] Sequoias which flourish along the [illegible] California coastal belt.

[illegible]s worth a stopover to see Sacra[illegible]nto, capital of California, site of Sut[illegible]'s Fort and hub of the state's richest agricultural area. Or gay and pleasure-loving San Francisco—hill climbing cable cars, Fisherman's Wharf, billowing fog, bright sun and perennial sidewalk flower vendors.

In Oregon, graceful Multnomah Falls drops 620 feet to the side of Columbia River Highway; a steaming volcano has long since subsided in the cool blue depths of mystic Crater Lake; vivid floral profusion flourishes below snow-covered Mt. Hood.

On up through Washington, the Evergreen State of great pine forests, sheltered inland seas, hidden ports of the San Juan Islands, gigantic power dams—Grand Coulee, high as a 46-story building, and Bonneville with its ship lock and unique fish ladders; orchards ruddy with apples, and Dry Falls over which the Columbia once plunged in volume equal to 40 Niagaras.

Or, taking the southern route, there are the charming city of San Diego, kelp beds harvested by seagoing lawn mowers, salt evaporating basins, the 200-inch mirror of Palomar Observatory, dude ranches and desert resorts.

You can't see them all in one trip, but if you're lucky you may be one of the 10 per cent that, statistics say, return to California.

1. Seen against palms and other semi-tropical vegetation, the State Capitol at Sacramento suggests an Oriental potentate's palace. 2. Spring comes late to the higher altitudes of Oregon where rhododendrons bloom on the lower slopes of Mt. Hood. 3. Eons ago a falls like 40 Niagaras rushed over those rocks, a tourist in Dry Falls State Park, Washington, tells his little girl. 4. Like a great elephant's foot, the base of a giant California Sequoia dwarfs a park ranger. Below, left: Modern buildings, ancient cable cars, Oriental pagodas, Occidental bridge engineering give San Francisco a cosmopolitan flavor. Right: Small blue boats anchored at Fisherman's Wharf after a day's haul charm sightseers in the Golden Gate city

NATIONAL PROGRAM COMMITTEE

Chairman
E. W. Baumgardner

First Vice-Chairman
F. J. Schmitt

A. D. Lewis

Second Vice-Chairman
G. A. Rogers

J. O. Horne
G. A. Rogers
W. G. Ehrhardt
C. N. Flick
A. A. Nichols
Gardner Young

FEATURED SPEAKERS

PROGRAM

OCTOBER 11, 12, 13, 1948

★ MONDAY, OCTOBER 11

8:30 A. M.

Registration Opens, *Galeria, Biltmore Hotel*

★ TUESDAY, OCTOBER 12

9:30 A. M.

Board of Directors Meeting, *Conference Room 1, Biltmore Hotel*
All-Day Trip to Kaiser Co., Inc., Steel Plant, Fontana, through scenic California countryside

1:00 P. M.

Plant Tours—U. S. Electrical Motors, Inc.; Firestone Tire & Rubber Co., Southgate Plant; American Can Co.; United States Steel Products Co.

★ WEDNESDAY, OCTOBER 13

9:30 A. M.

All-Day General Tour of Motion Picture Lots and Beach Area

1:00 P. M.

Plant Tours—Aluminum Company of America, Vernon Works; Owens-Illinois Glass Co., U. S. Electrical Motors, Inc.

K. T. Norris

Edward Arnold

H. L. Hibbard

.S.T.E. 16th Semi-Annual Meeting

E BILTMORE HOTEL — LOS ANGELES, CALIFORNIA

9:30 A. M.

Day Tour, Lincoln-Mercury Assembly Plant, Ford Motor Co.; Los Angeles Harbor Area and Signal Hill

1:00 P. M.

Plant Tours—United States Steel Products Co., American Can Co.

8:00 P. M.

Technical Session, *Music Room, Biltmore Hotel*
Chairman, Fred J. Schmitt, Director of Sales, D. A. Stuart Oil Co., Chicago, Ill.

"Adventures in Space," Hall L. Hibbard, Vice-President and Chief Engineer, Lockheed Aircraft Corp., Burbank, Calif.

Ladies' Fashion Show, *Biltmore Hotel*

8:00 P. M.

Technical Session, *Music Room, Biltmore Hotel*
Chairman, Arthur D. Lewis, Owner-Manager, Art Lewis Production Equipment Co., Glendale, Calif.

"The Part Played by Controlled Directional Drilling in Today's Major Drilling Program," Gordon Jackson, Vice-President and General Manager, Eastman Oil Well Survey Co., Denver Colo.

"Oil Well Cementing," William G. Owsley, Chief Technical Advisor, Halliburton Oil Well Cementing Co., Duncan, Okla.

"Oil Field Standardization," Hallan N. Marsh, Production Engineer, General Petroleum Corp., Los Angeles, Calif.

"Exploration," A. C. Rubel, Vice-President, Union Oil Company of California, Los Angeles, Calif.

"Technical Aspects of Drilling" D. S. Faulkner, Vice-President, National Supply Co., Torrance, Calif.

"Refining," O. N. Miller, General Manager, Manufacturing, Standard Oil Company of California, San Francisco, Calif.

Radio City Tour for Ladies

7:45 P. M.

Semi-Annual Dinner, *Ballroom, Biltmore Hotel*

Toastmaster, Edward Arnold, Radio and Motion Picture Actor

Address, "Western Industrial Problems," Kenneth T. Norris, President, Norris Stamping and Manufacturing Co., Los Angeles, Calif.

Entertainment

Dancing

All Three Days—Personally conducted sightseeing tours for ladies

Los Angeles ASTE Ladies, Hostesses

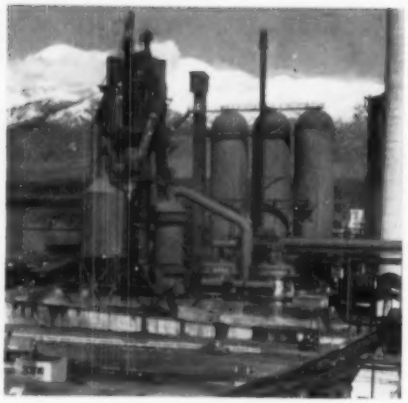
A. C. Rubel

O. N. Miller

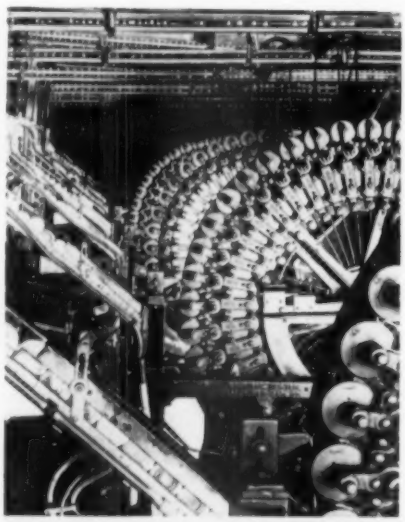
H. N. Marsh

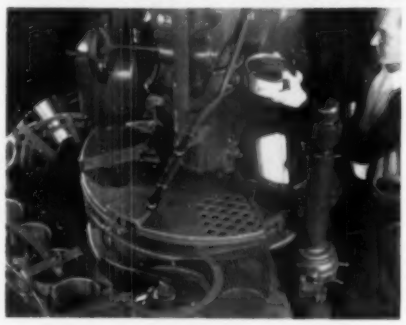
W. G. Owsley

Gordon Jackson



made in california





CLOTHED IN new, modern, sometimes semi-open buildings, and animated by up-to-the-minute equipment, the young industrial Los Angeles will stir admiration—even envy—in production men from older manufacturing centers.

Newest on the list of branch plants of nationally known companies to be visited by ASTE is the Lincoln-Mercury assembly plant of the Ford Motor Co. Dedicated with fanfare May 6, it is said to be the last word in factory design, production efficiency, industrial know-how and mechanical skill.

Nearly five and a half miles of overhead conveyors move parts to the final assembly line where operators, using hydraulic lifts for the heaviest pieces, fit them into place. Chassis, body, engine, fenders and grill begin at separate points and travel along the synchronized lines, so that the car assembly receives parts in the proper color for the right model the instant they are needed.

In conjunction with this trip, the Los Angeles-Long Beach Harbor, which shelters the Pacific fleet within the world's longest breakwater, and Signal Hill, thickly studded with oil derricks, will be visited.

Another all-day excursion, passing through orange groves backdropped by snow-capped mountains, will have the Fontana Steel Mill of Kaiser Co., Inc., as its destination. Inspection will start with raw materials, coke ovens, and blast furnace, where the processing begins. There ladle cars carry molten metal to the open hearth building for refining.

Ingots are reheated, for rolling, in soaking pits at the stripper plant, then reduced to slabs in the blooming mill and rolled into various forms in one of several mills.

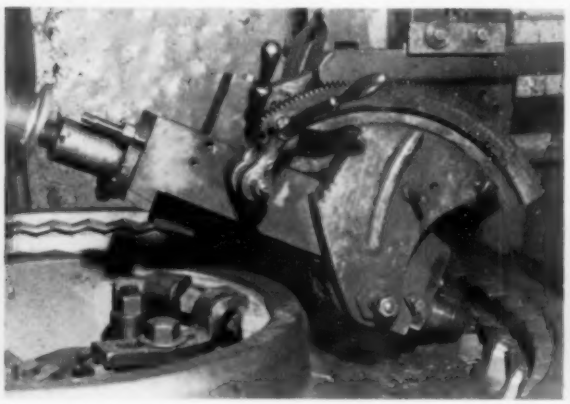
The Kaiser Co. management will be luncheon host for the ASTE party.

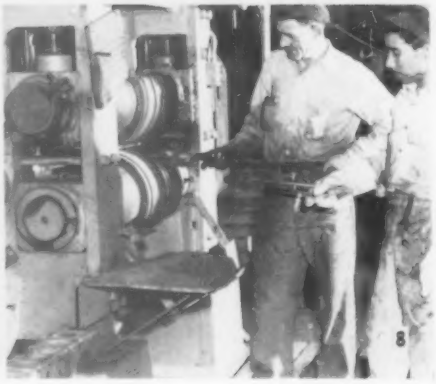
At American Can Company, completely automatic production lines turn out 375 tin cans per minute. Rolled steel sheets thinly coated with tin are painted, dried, cut, formed into cylinders and side-seamed.

After soldering, the body is flanged on both ends. A rubber gasket material baked into the groove of the bottom section forms an airtight bond when the parts are joined.

Other high speed production lines perform comparable operations on wood fibre material for milk containers. The company also builds its own machines and makes its tools.

From top: Snow-capped mountains and fragrant orange groves form a scenic background for the Kaiser steel plant blast furnace at Fontana. A marvel of tool engineering is the can testing machine designed, built and used by American Can Co. In the doubleseamer below, finished can bodies and ends are joined. Bottom row, left and right: At U. S. Electrical Motors plant, an operator broaches Varidrive pieces, while another grinds a Varidisc. Center: A special engraving machine at the Firestone Tire & Rubber Co. plant cuts the tread design on a tire mold





1. At the Kaiser steel plant, hot metal is charged to the open hearth furnaces, and (2) glowing steel is rolled in the merchant mill. 3. A workman pours molten aluminum for sand castings at Aluminum Company of America's Vernon Works. 4. This 1949 Lincoln is completed as headlights are set. 5. Metal finishers sand Mercury body parts at the new Los Angeles assembly plant of Ford Motor Co. 6. Production lines turn sheet steel into oil drums, loaded into freight cars, in less than 20 minutes at United States Steel Products Co. 7. A King boring mill cuts ribs on a Firestone insert type mold. 8. Forge rolling is used on hoe socket at U. S. Steel Products

Motor making will be studied at U. S. Electrical Motors, Inc. Castings are first normalized to prevent warping. Special company designed and built machines bore and face gear cases; motor windings and coils are immersed in a bath and asbestos fibres are deposited electrostatically in the interstices between the wires. In producing motor laminations, simple dies are used. Gear cutting, shaving, hollow shaft boring, grinding, and balancing are among other operations to be demonstrated.

Representative of the Los Angeles tire industry, second only to Akron's, is the Firestone Tire & Rubber plant where 10,000 tires and accompanying tubes are produced daily.

After viewing a color film of tire manufacture, the ASTE group will follow the camera's path, beginning with stores of crude rubber, through plasticating and compounding, then to milling, and testing. Next, extruding machines form tubes, treads and sidewalls, and calendering machines skim-coat gum-dipped fabrics.

Stock preparation features machines for bias cutting and bead assembling. Tire building is followed by bagging and shaping. The ASTE guests will watch the vulcanizing process, then enter the tube room and, finally, the inspection department. A high point of interest, of course, is the machine shop and mold section.

Significantly tied in with a leading West Coast industry, the Vernon Works of Aluminum Company of America will show how forgings, castings and extrusions for aircraft are made, as well as extruded aluminum pipe for farm irrigation.

From raw stock to finished tool, farm and garden hand implements are made before your eyes at Boyle Mfg. Div. of United States Steel Products Co. Containers, too, are an important product, a 55-gallon drum for petroleum derivatives being converted from a flat sheet of 18-gauge steel, flash butt welded, flanged, swedged, doubleseamed, tested, washed, dried, painted, and loaded into a freight car—all within 20 minutes.

Unique among ASTE plant tours is one scheduled for the Owens-Illinois Glass Company's bottle factory, operating conditions permitting. Starting from the preparation of the raw batch, the engineers will see it melted in the furnace and formed by machine into bottles, on through the selecting, and applied color decorating. A color-sound film will precede and explain the tour.

FOR LADIES ONLY

WHILE THE MEN in your lives are drooling over modern, high precision machine tools in Los Angeles plants and boning up on how the West tools its own industries, you ASTE ladies will be busy going places and seeing things.

Under the wing of local members' wives, you'll be taken in private pleasure cars to many of the sought-out points of interest. Major ambition of every woman Jill among you, of course, will be to acquire some of the gay, casual California fashions, so Wilshire Boulevard with its "Miracle Mile" of ultra-ultra shops will probably be the first stop. It's fun to look, though.

Lunching at the Brown Derby you can scrutinize the creations of Hollywood custom dressmakers as worn by the movieland greats. And svelte models will parade advance modes at an evening fashion show in the Biltmore.

At the other extreme, in Olvera Street you can haggle with Mexican vendors over handcrafted leatherwork, pottery, glass, candles, baskets, and silver jewelry, or adventure with zestful foreign dishes at sidewalk safes served by costumed senoritas.

You'll feel transported to the other side of the world when you see the "House of Wang" from the "Good Earth," reproduced in red sandstone, complete with lotus pools, a temple and cobbled streets, in one of the three Chinatowns.

Radio and TV fans will really have something to write home about when they see their network favorites in the flesh. One evening will be devoted to doing Radio City, where the majority of coast-to-coast broadcasts originate.

Garden devotees will "oh" and "ah" at the seven and a half acre plot of Californias choicest and rarest roses, in Exposition Park.

Out Pasadena way, the Henry E. Huntington Library is a veritable treasure house of art objects and precious manuscripts. Fifty of the 200 acres of Botanical Gardens are open to visitors.

Los Angelenos take their government with art on the side, as you'll discover in the City Hall gallery. From the 27-story tower, highest structure in Southern California, you'll gasp at the magnitude of the vast metropolitan area.

Even in death Hollywood demands glamour. At Forest Lawn Memorial-Park cemetery, the stars are buried—and married. Here is the familiar "Wee Kirk o' the Heather," impressive edifices, formal gardens, a parklike tract of winding drives sprinkled with memorial statuary, and the magnificent "Last Supper" window recreating Leonardo da Vinci's nearly obliterated painting. Each hour lectures are given before the stained glass masterpiece over which the last of a family of Italian glass artists toiled six years.

You'll enjoy prowling about the kitchen of San Gabriel Mission with its cistern, the tannery vats, olive and wine presses, aqueduct and fountain, candle and soap factories with their huge ovens. Established in 1771, the church is believed the best preserved of the early Spanish houses of worship.

The museum boasts paintings older than the Mission, parchment books, statues, rich vestments which are used for solemn weddings, and relics excavated from the Quadrangle.

And these are only a few of the high spots on the itinerary planned for you by your Los Angeles hostesses.

1. Masses of roses, from the humblest to most exotic, bloom all year 'round in Exposition Park. 2. Aboriginal paintings, other works of art, and relics excavated from the quadrangle of San Gabriel Mission are reminders of the early Spanish days when the padres founded a string of missions along El Camino Real. 3. California fashions are displayed in some of America's smartest shops along "Miracle Mile" on Wilshire Boulevard. 4. The "Finding of Moses" fountain is among the appealing statuary gracing Forest Lawn Memorial-Park cemetery. 5. Pasadena's Huntington Library contains priceless tapestries, sculptures, paintings and manuscripts. "The Last Supper" window in the Memorial Court of Honor at Forest Lawn, a re-creation in stained glass of da Vinci's masterpiece, is made from his original sketches

Introducing Los Angeles Convention Committee Chairmen

Host Chairman
L. F. Hawes

Banquet, Session Arrangements
M. W. Seavey

Plant Tours
Anton Peck

Technical Programs
R. G. Stronks

Publicity
Rudolf Regen

Transportation
Wayne Ewing

Reservations, Registration
J. E. Ekstromer, Jr.

Reception
A. D. Lewis

Supplementary Activities
G. J. Walkey

Emergency
R. H. Kollenborn

Signs
H. S. Bamberger

Records and Reports
Carl Wight

Entertainment Co-Chairmen
J. A. Parks

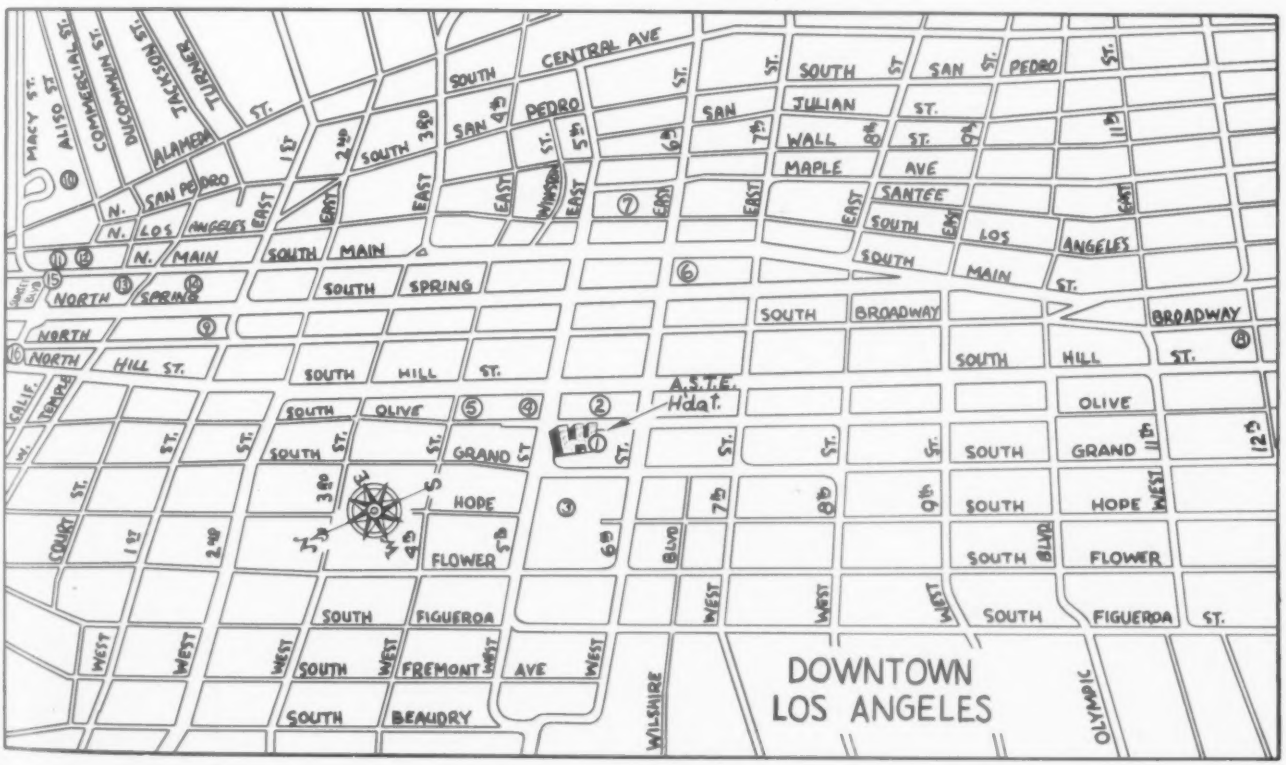
R. R. Linch

Tickets
H. A. Miller

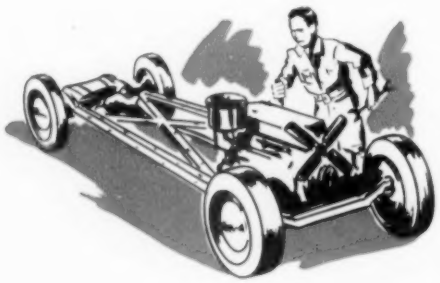
Budget
Rudolph Powroznik

What to Look for in and around Downtown Los Angeles

1 The Biltmore Hotel
2 Pershing Square
3 Public Library
4 Philharmonic Auditorium
5 Subway and Bus Terminal
6 Santa Fe Bus Depot
7 Greyhound Terminal
8 Chamber of Commerce
9 Civic Center
10 Union Station
11 Mexican Quarter
12 Old Mission Church
13 Federal Building
14 City Hall
15 The Plaza
16 To Chinatown



The greatest single factor in the growth of industry on the Pacific Coast is generally recognized as the continued expansion of the primary metal industries, producing iron, steel, aluminum, and other essential materials for the many metals consuming industries flourishing in the West. While steel production is still far short of the country's total the Coast's producers of primary aluminum hold more than half of the Nation's total capacity. Increased market demands, future development of new ore fields, and the solution of power and other problems will help to maintain this industry's rate of acceleration.



Automotive production is usually thought of as synonymous with Detroit; however, more and more auto assembly plants are taking root on the Coast, with one incentive being the high number of car registrations (California leads the nation). As supply sources become available, parts are bought in the West, with the rsultant tooling requirements running into BIG figures. Currently, automobiles are being assembled at a rate of over 300,000 annually. Not to be omitted, the West Coast is an important manufacturer of trucks, buses, street cars, railroad equipment, and other allied products.

Surpassing War Year Records . . .

"A SNOWBALL OF HUMAN AND ECONOMIC DESTINY is rolling in the West. The greatest mass migration of people in American history continues rolling into the western states. And with it, the industrialization of the West rolls on like a giant snowball, gaining in size and momentum."

These words, spoken recently by Henry Kaiser—who, to many Americans, symbolizes West Coast initiative and drive—are vividly descriptive of the tide of progress on the Pacific, but at the same time can only begin to tell the story.

In the year ending March, 1948, *new* nonresidential building construction authorized in all Pacific Coast urban areas had a permit value of $301,658,000.

In 1947, 215 new industries entering Los Angeles County alone made capital investments of $69,852,000, while 417 local industries in the same area started expansions requiring additional capital investments of $54,959,500. The combined increased production capacities, it was estimated, would provide employment for 21,346 persons. The early months of this year show that the pace continues unabated.

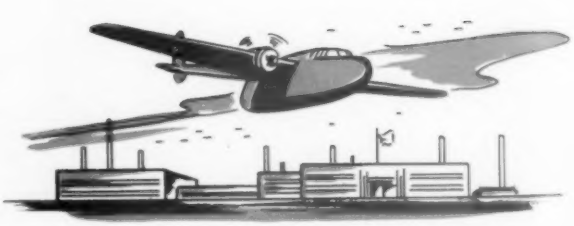
Los Angeles, booming ahead at top speed, outranks other West Coast industrial centers. Los Angeles County is claimed already to rank first nationally in the production of oil field equipment, aircraft, sportswear and, of course, motion pictures; second in automobile assembly, rubber tires and rubber goods; third in food products; among the top three in petroleum refining; and fourth in furniture manufacture.

It would be difficult indeed to estimate the amount of tooling required for West Coast industry. The 1947 Census of Manufactures, not yet available, should reveal some highly interesting figures. Some indication may be found in a survey made in Los Angeles County, where there are 611 steel consuming plants employing 25 or more persons (and 29 of these employ more than 500), and 960 plants employing less than 25.

Each of these steel consuming plants, operating in 36 major manufacturing classifications, require a certain amount of tooling. And some manufacturers—like Boyle Manufacturing Div'n of U. S. Steel Products Co., with 500 different products—have such diversified and progressive lines as to necessitate extensive and continuous tooling programs.

The purchasing demands for machine tools, dies and fixtures, and cutting tools; machine components; and metals, chemicals, industrial finishes, and other materials are increasingly heavy.

World War II drew the Nation's attention to the West Coast as a production area. And, in the eyes of the Nation, shipbuilding and airplane construction were the two focal points of wartime activity. The aircraft industry remains . . . firmly entrenched in the industrial life of the West, building planes for peace and for national security. With a backlog of nearly a billion dollars in orders, this industry will continue to be pacemaker for the West.



Pacific Industry Forges Ahead

By Watson N. Nordquist

More and more of these mass-production needs are being met in a West striving for realization of a self-sustained, integrated economy.

In the rush to mechanize the basic Coast industries—logging and forest products manufacture; agriculture and food packing; mining and metals processing—the tool engineer is an important figure, designing the means of turning out more goods, at less cost, and of higher quality.

There is also need of his knowledge and creative ability in the multitude of comparatively small manufacturies of consumer needs. The A.S.T.E. is proud of its 1000 members on the Pacific Coast, and of the work they are doing.

Although high rail tariffs offer partial reason for industrial expansion in the West, the railroads serving that area are happy about the whole movement. Union Pacific R.R., claiming to have more than 1,000 new industries locate on its trackage since V-J Day, has in that same period invested over $250,000,000 in new equipment . . . an investment, actually, in the future of the nation and particularly of western industry.

A large share of the railroads' needed equipment is being provided by such manufacturers as Pacific Car & Foundry of Renton, Washington, where a fleet of 1000 modern refrigerator cars are being built for Pacific Fruit Express.

The rest of America, in general, may look back at their prewar impressions of the Coast's populace and remember . . . movie colonies, shipping magnates, the great labor groups of Mexicans and Japanese, and the Scandanavian lumbermen of the Northwest. Now the great migration to the Coast brings those seeking escape from asthma, sinus, or rheumatic fever; those who are promoters; and those with industry and vision honestly seeking happiness and prosperity on this westward horizon.

The U. S. Bureau of Census estimates that by July 1, 1947, the three West Coast states had a population of 13,462,000—an increase of 40% since April 1, 1940. Conservatives estimate that yet another half-million have settled there within the last year.

One consequence of this exodus is that industry moving to the Coast has, in general, found a job-hungry labor supply. While some areas still require large numbers of certain types of skilled help, there is a labor surplus for the three states estimated to be currently more than 200,000.

New western sources of raw materials have become an important consideration in the economies of West Coast production. The easy accessibility of seaport facilities, by direct rail or modern highway, from practically any point in the three Coast states, has enabled western industry to economically carry on a substantial foreign trade.

The growing population of the western states, plus the great low-income markets of the Latin American countries, the Orient, and the Pacific Isles, offer tremendous outlets for West Coast goods, provided industry on the Coast can meet the challenge, can turn out great quantities of a mass-consumed product at a very minimum cost, without impairing its present pay scale. The development of western Canada and of Alaska give greater breadth and depth to this challenge.

Dry cargo moved through Pacific Coast ports for foreign trade increased from 7,702,000 tons in 1939 to 9,089,832 tons in 1947.

Many companies—such as Standard Oil of California—are located directly on the coastline, where they maintain their own docks for speed and economy in supply and distribution.

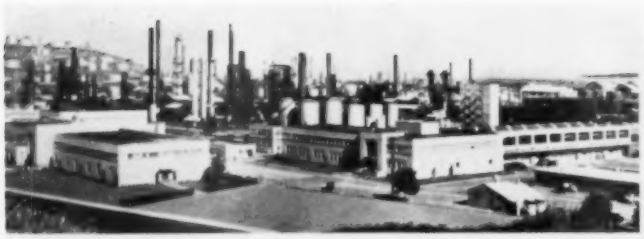
More and more suppliers have been opening up West Coast branches or outlets. This has been encouraging to western manufacturers both from the service and the cost standpoint. Of course, there are a great many items that are still most efficiently mass produced in the eastern centers. Many of the West Coast purchasing requirements have led to the establishment of suppliers who concentrated on specialized small-run production, who do not yet have the experience in handling mass production orders on a competitive basis.

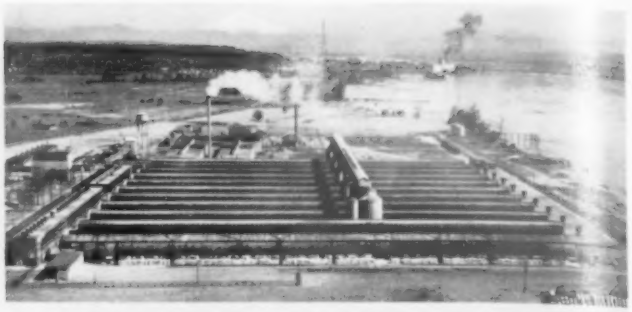
Among the many industries contributing to the overall economy of the West are the mining and the metals processing, the logging and the lumbering, the agricultural and commercial fishing industries . . . all supplying the materials for manufacturing. Industries providing end products include the forest products, motor vehicle, aircraft, shipbuilding (now at a virtual standstill), food packing, chemical, clothing, motion picture, rubber, printing and publishing, ceramics, and many others. Providing the tools for production are manufacturers of presses, dies and fixtures, motors, pumps, and cylinders . . . to name a few.

(Continued on next page)

Although of less prominence in the public eye, the chemical industries of California, Oregon, and Washington have already reached incredible proportions. The amazing growth in the plastics field, alone, has clearly demonstrated the ingenuity of the industry and its awareness of its potentials.

With some of the world's richest oil fields located in California, petroleum is *big business* in that state. During the last decade, millions of dollars have been expended on the exploitation of these oil deposits. Los Angeles County ranks among the top three areas in the country in petroleum refining, while being the largest producer of oil field equipment. Production of petroleum products creates a heavy demand for sheet metal, piping and tubing, valves, pumps, metal containers, and countless other products.





Typical of California's diversified industrial plants are those shown above. Top photo, left, shows the Richmond refinery of Standard Oil of California, with the recently completed $2,000,000 laboratory buildings of California Research Corp'n (a Standard subsidiary) prominent in the foreground. Below it is a view of an oil refinery absorption plant near Martinez. This is one of many plants which are dependent, for water, on the Contra Costa Canal, one of the first Central Valley Project units to be completed. Top photo, right, is the Vancouver plant of the Aluminum Company of America. In the lower photo, right, can be seen the world's mightiest lifting force, a giant crane installed at the San Francisco Naval Shipyard and designed to lift loads as great as entire 400-ton gun turrets from battleship to re-gunning mole which it services. The crane is here flanked by aircraft carriers Intrepid and Hornet, which are dwarfed under its 730-ft. long cantilever span.

Raw Materials for Manufacture

The 1946 yield of $559,449,496 from the mineral deposits of California was an increase of $85,787,905 over the previous record-breaking year. Washington's mineral production for 1946 ran to $33,076,000, while Oregon's was $12,400,000.

California's Petroleum

Operations of Union Oil Co. of California now include properties in 11 states, Alaska, Canada, and Paraguay. During the last decade, production activities required an investment of $114,000,000 but resulted in the present proved net crude oil reserves of 418,900,000 barrels, a daily crude oil production of 81,000 barrels, and a gasoline yield of 36% as against 20% in 1937.

During the same 10-year period, Union Oil invested $73,000,000 in refining and manufacturing facilities, and another $20,000,000 in transportation facilities. A $10,000,000 lube oil plant to be located near San Francisco will produce high quality lubricating oils and greases.

Union oil research has resulted in the recent development of a commercial process, Hydrosorption, for the economical recovery of ethylene from refinery hydro-carbon gases.

Another large producer, Standard of California is midway in an expansion program estimated at $33,000,000. Modernization of facilities at the Bakersfield, Cal., refinery will about double its crude capacity, bringing it to 20,000 barrels a day. Installations completed at Richmond and El Segundo refineries have substantially increased their capacities.

Steel Production

Facilities for helping to meet the material needs of the new industrial West are rapidly taking physical shape, with the United States Steel Corp'n expending $120,000,000 on western expansion involving facilities of two major subsidiaries, Geneva Steel Co. and Columbia Steel Co.

When in full production, the Geneva, Utah, plant will provide hot rolled coils to the cold reduction facilities recently completed at the Pittsburg, Cal., mills of Columbia Steel. Pittsburg already has rolling, rod, wire, wire rope, and nail mill facilities, and produces fencing, springs, sheets, and carbon and alloy steel castings.

To include tin plate facilities, the Pittsburg expansion program will require the addition of about 800 employees to its present 2900. Another 30-million dollar cold reduction mill is being planned for the Los Angeles area.

Henry Kaiser's Fontana plant, 45 miles east of Los Angeles, is being expanded: 1) In January a $7,000,000 pipe mill was opened, with a capacity for producing in one 8-hour shift enough ½" to 4" pipe for 1,000 average American homes. 2) To start operation by the end of July, a whole mountain of high grade iron ore, 52 miles from Fontana, is expected to meet Fontana's estimated requirements for the next 100 years.

To be added: 3) Rolling facilities to produce hot steel sheets up to 78" wide and 14-gauge minimum thickness. The annual production of 100,000 tons of coils and flat sheets will feed the West's manufacturers of barrels, oil and domestic water tanks, pipe, rail equipment, auto frames, and heavy sheet metal. 4) An electric weld pipe plant with an annual capacity for 100,000 tons of pipe from 5" to 14" dia., pipe badly needed in the oilfields, and for gas and water lines. 5) An additional open hearth furnace, with a capacity of 144,000 tons a year.

Alcoa's Vancouver Works—producing aluminum pig and ingot—has an annual production capacity of 170,000,000 lbs., and employs about 1000. The Vernon (Los Angeles) Works—producing extruded shapes, forgings and pressings, drawn tubing, rivets, commercial ingot, sand and permanent-mold castings—employ about 1500.

Expanding Aluminum Facilities

Alcoa plans to erect a plant, probably near the Vancouver Works, for the manu-

Crude section of Union Oil of California's Los Angeles refinery. D-2 fractionating column, left in photo, separates light straight run gasoline fractions. D-3 vacuum column, at center, separates straight run diesel and gas oil. D-1 fractionating column, right, separates heavy straight run gasoline and stove oil.

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To simplify your personal arrangements, just fill in the post cards below, tear them out, mail as directed, and your transportation, hotel and banquet reservations will be made for you.

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SPECIAL TRAIN—Eleven new, stainless steel and aluminum cars have been reserved for ASTE. Two are all-room cars, two, all-roomette; and three are made up of bedrooms, roomettes, compartments, drawing rooms and berths. In addition there is an observation car carrying several rooms, besides a club car, full diner, and a lounge car.

Lots of room to move around, visit with old friends, make new ones, and view the ever-changing scene. Plenty of time to linger over Fred Harvey food, munch between-meal snacks, and sip refreshing beverages. Every convenience in your private, rolling hotel room—from clothes closet to outlet for your electric shaver—plus, of course, room service at your constant beck and call.

The Diesel-powered streamliner glides out of Dearborn Station, Chicago, at 12:01 Noon, Thursday, October 7, pulls into Los Angeles at 11:30 A.M., Sunday, the 10th. Or you can join the trip at Kansas City, Mo.; Newton, Kan.; La Junta, Colo.

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(Now turn the page and we'll tell you how to handle hotel and banquet reservations.)

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HOTEL RESERVATIONS—Headquarters for the three-day convention will be the luxurious Biltmore Hotel overlooking two city parks—in the heart of downtown. Convention meetings will take place on the palatial Galeria floor.

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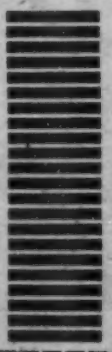

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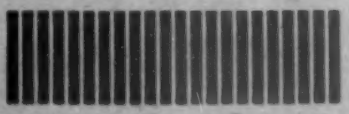


...e of aluminum wire, rod, and elec... transmission cable.

...ynolds Metals Co. operates three ...inum plants in the West. The re...on plant at Troutdale, constructed ... cost of $19,000,000, has an annual ...ity of 144,000,000 lbs. of aluminum ... That at Longview has an annual ...ity of 65,000,000 lbs. The $35,000,... extrusion mill at Phoenix, Ariz., has ...nnual capacity of 60,700,000 lbs. of ...ded shapes and tubing.

...perations of Permanente Metals ...p'n (a Kaiser interest) range from ...ing of the bauxite ore through rolling ...aluminum sheet. Its Spokane mill in ...e rolled a record-breaking 27,000,000 ... of aluminum.

Permanente's construction plans include an aluminum foil plant at Permanente, in the San Francisco Bay Area, to produce foil used by many Coast industries for packaging and for manufacture of electronics, refrigeration, and air conditioning equipment. An aluminum rod and bar mill will supply manufacturers of articles from nails and ornamental trim to tools and farm fencing.

Other Metallurgical Industries

The plant of Tacoma Powered Metals Co. produces powdered iron—for oil-less bearings used in the automotive and other industries—by a unique electrolytic process. The low cost of electric power, a local availability of hydrogen gas, hydrochloric acid, and other raw materials made Tacoma an ideal site.

One of the byproducts from the Tacoma Smelter of the American Smelting & Refining Co. is slag, the basic raw material for feltrock insulation produced by Feltrock Mfg. Co., of Tacoma, a pioneer in the field of home-insulation.

We have been able to mention only a few of the metals producing plants on the Coast. Those included here give some idea of the investments and progress being made in order to provide the present and future metals working industries of the West with the necessary materials.

The Chemical Industries

Complete coverage of the important chemical industry, or for that matter any of the industries of the West Coast, would be impossible in this brief article. A few examples are here given to illustrate how chemical enterprises, supplying West Coast markets, and purchasing from West Coast sources, have developed.

W. P. Fuller & Co., the West's largest paint and varnish manufacturer—supplying such diversified industries as furniture, aircraft, refrigerator, and leather goods—is nearing the completion of a million-dollar Industrial Finishes Building at its South San Francisco plant. Additional factories at Portland and Los Angeles help feed Fuller's distribution network serving 11 western states, Alaska, Hawaii, and Latin America.

In turn, W. P. Fuller & Co. is a user of large quantities of such western products as dry pigments, synthetic resins, vegetable oils, petroleum products, containers, and others.

At Tacoma, Wash., the Hooker-Detrex Corp'n recently built a chemical plant for the production of trichlorethylene, a solvent for degreasing and cleaning. This plant was located alongside the chlorine caustic plant of the Hooker Electrochemical Co. in order to have a convenient source of chlorine, a necessary raw material. Calcium carbide, another essential, is received from production plants at Portland, Ore.

Automobile Assembly

Automobile assembly has in recent years become "big business" on the Coast. One of the most recent additions to this industry was the opening this Spring of the $7,000,000 Lincoln-Mercury plant at Los Angeles. This plant will employ 1500 workers, producing 200 cars each 8-hour shift.

Ford also operates plants at Long Beach and Richmond, where cars in the lower brackets are produced. This one company now spends in California, aside from wages, about $35,000,000 a year, largely for area-manufactured parts.

To employ about 800 people, the recently opened Dodge plant of the Chrysler Corporation at San Leandro will probably turn out 150 passenger cars and 80 Dodge "job-rated" trucks each 8-hour shift.

The Chevrolet plant at Los Angeles and the Willys plant at Maywood are among others which have been established in California.

Marine Industries

While shipbuilding was an important wartime activity on the Coast, it has been negligible except for those years of 1940 through 1946. Servicing of large ocean-going vessels, as well as the building and maintenance of small craft, is and will continue to be a major industry on the Coast. The volume of foreign trade shipping through ports on the Pacific, and the continuing operations of the great fishing fleets, generates business for manufacturers of diesel engines, hardware, sails, tackle, and so on.

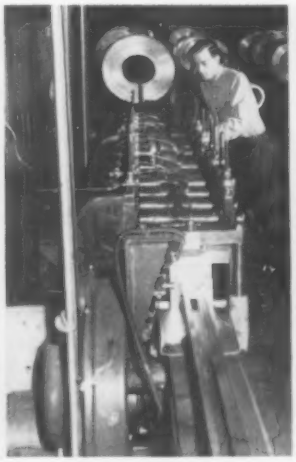
The San Francisco and the Puget Sound Naval Shipyards are busy helping to put the wartime fleet in "mothballs," in addition to servicing ships still active. The San Francisco yard has recently added three finger piers, costing $6,000,000, a $4,500,000 structural steel shop, a $2,500,000 ordnance, electronics, and optical shop, and other improvements.

Other Expansions

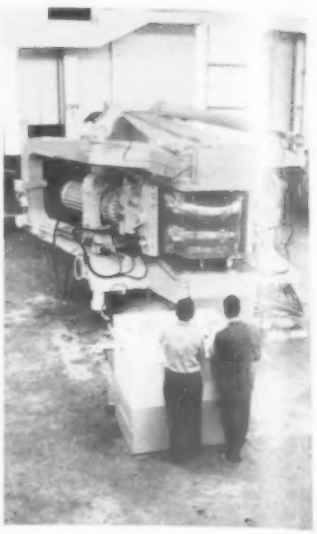
First equipment to be installed at the Santa Clara plant of the Owens-Corning Fiberglas Corp'n will be two glass furnaces and wool lines for Fiberglas thermal insulation materials. Plastics reinforced with Fiberglas are already extensively used on the Coast in aircraft, boats, appliances, outdoor signs, and other products.

The San Jose $3,000,000 Amino products chemical plant of the International Minerals & Chemical Corp'n, opened in May, processes a byproduct from the desugaring of beet sugar molasses into a food flavor accentuator.

The Torrance pottery plant of American-Standard has been completed and is in operation. Eventually more than 500 persons will be employed, producing a line of vitreous china products. The same firm will employ more than 500 at its brass plant just completed at Richmond, where plumbing fittings will be manufactured.



Above, left, gushing, white-hot steel pours from the spout of a basic open hearth furnace at the Pittsburg, Cal., plant of Columbia Steel Co., western subsidiary of U. S. Steel Co. An overhead crane will carry the 90-ton ladle to the ingot molds. The center photo shows Kaiser aluminum siding being produced by a mill at the Spokane plant of Permanente Metals Co. Dies are changed for the various siding components, such as the corner flashing shown here. In the photo to the right, a 1949 Lincoln Town Sedan body is being lowered onto the chassis at the body drop in the new Lincoln-Mercury Assembly Plant, Los Angeles.



Shown above, left, the war-made-famous master tooling deck is set up for the fabrication of outer wing panels for the 1948 Ryan Navion, a peacetime product. Largest of peacetime aircraft are the Boeing Aircraft Company's 80-passenger, 340-mph Stratocruisers. In the center photo, workmen are making final installations on the double-deck luxury liner's foldable vertical tail. As of July 1, 55 of these giant birds were on order by major airlines. At the right, the $34,000 stretch forming machine, recently built by Hufford Machine Works to specifications of North American Aviation, Inc., is shown with an aluminum sheet pulled around a die. The even stretching of the stock results in a formed part with more uniform strength than can be obtained otherwise.

While not the bonanza earlier predicted by some, the market for light planes is providing a nice business for at least Ryan Aeronautical Co., San Diego, manufacturer of the Ryan Navion, popular four-place, all-metal personal-business craft. Ryan also maintains a metal products division, a leading supplier of exhaust systems and other aircraft engine accessories; and a division for fabricating rear fuselage sections for the Boeing Stratocruiser and Stratofreighters.

Aircraft Still Tops

Ryan has been a leader in developing techniques and equipment for handling stainless steel, from which its exhaust manifolds, jet engine components, and engine accessories are made.

In addition to the Stratocruisers in demand by the world's leading airlines, Boeing Airplane Co. of Seattle is providing planes for the Air Force. With a backlog estimated at about $300,000,000, Boeing's post-strike employment will probably be about 14,000.

Boeing was one of the first in the industry to use spotwelding on a large scale, and pioneered in the use of heavy duty metal working production machinery, such as planers, hydro-presses, and so on.

North American Aviation, Inc., operates plants at Los Angeles, Long Beach, and Downey, employing more than 20,000, with a $400,000,000 backlog of orders from the Air Force.

Northrop Aircraft, Inc., at Hawthorne, Cal., currently holds military orders totalling $100,000,000, including 13 propellor-driven versions of the Flying Wing. Present employment of 5200 will probably be increased to 9000 or more.

The latest to consider the manufacture of other than aviation products, the Douglas Aircraft Co., Inc., Santa Monica, on July 19 announced the formation of a new metal products division to produce such products as automobile fenders and radiator shells.

Producing Consumer Goods

A very large part of Pacific Coast manufacture is devoted to the production of consumer goods. A few of the firms in this field are: Utility Appliance Corp'n, Los Angeles, making heating and air conditioning equipment including the new Wall-O-Matic furnace; Frenton Steel Works, Seattle, steel and aluminum windows; Thor Corp'n, El Monte, Automagic washing machines; and Erie Mfg. Co., Belmont, electric fruit and vegetable juicers.

Standard Structures, Inc., Sacramento, is now shipping a prefabricated 5-room bungalow and car port in a single steel strapped unit 22′ x 8′ x 9′.

Los Angeles, already occupying a leading position nationally in the apparel industry, is looking forward to development of a cotton textile industry which would fully utilize the 700,000 bales of cotton now grown annually in California and Arizona.

Heliarc welding, adopted by engineers at Northrup Aircraft, Inc., for the effective use of magnesium during the wartime aluminum shortage, is shown above applied to stainless steel. The helium gas which bathes the weld results in a stronger "quenched" joint.

The three Pacific states lead the nation in the production of lumber and forest products. In 1945, Oregon turned out 5,003,547 M ft. of lumber, Washington 3,257,995 M ft., and California 2,260,792 M ft. In 1940, the last year for which figures are available, California used 920,445 M ft. of wood in manufacture, Washington 740,059 M ft., and Oregon 695,090 M ft.

One of the real tooling achievements on the Pacific is to be found in the plywood industry of the Northwest. Here 31 factories, owned by 24 separate firms, are making virtual daily innovations in the machinery and techniques for the mass-production of Douglas fir plywood.

Forest Products Industries

New uses for wood, and improved existing uses, favor development of dependent industries. Weyerhaeuser Timber Co. is now processing Douglas fir bark into five products, used in molded plastics, insecticides, soil conditioners, and as a glue extender in the adhesive for binding wood veneer into plywood panels.

Between 400 and 500 persons will probably be employed at the plant to be built by Masonite Corp'n at Ukiah, Cal., for the production of wood fibre hardboard.

Among the many manufacturers supplying the lumbering industry is McCulloch Motors Corp'n, Los Angeles. One of this firm's featured products is a chainsaw engine, used primarily in the lumbering trade.

The Hyster Company makes about 29 different tools and attachments—designed specifically for the logging industry—which are performing Herculean work in moving gigantic Redwoods and other large timber to the mills.

Philadelphia Quartz Co., Tacoma, produces large quantities of sodium silicate, a raw material for local and nearby plywood, fibre-board, and carton packing industries.

Products Industries

The continued growth of the agricultural industry in the western states is vital to the economy of the Pacific Coast. The farming populace constitutes a large share of the western mass market for mass produced consumer goods, while the industry itself is a large customer for irrigation pumps, tractors, conveyors, and other mechanized equipment. And, the food packing industry uses a large volume of materials-handling and automatic processing and packing equipment.

Among the Pacific Coast manufacturers whose growth have paralleled that of the agriculture industry is the Gladden Products Corp'n of Glendale, a principal supplier of 4-cycle, single cylinder, air cooled engines for rural use.

A continuing market for irrigation pumps has aided the growth of Jacuzzi Bros., Richmond, making gasoline and electrically driven units.

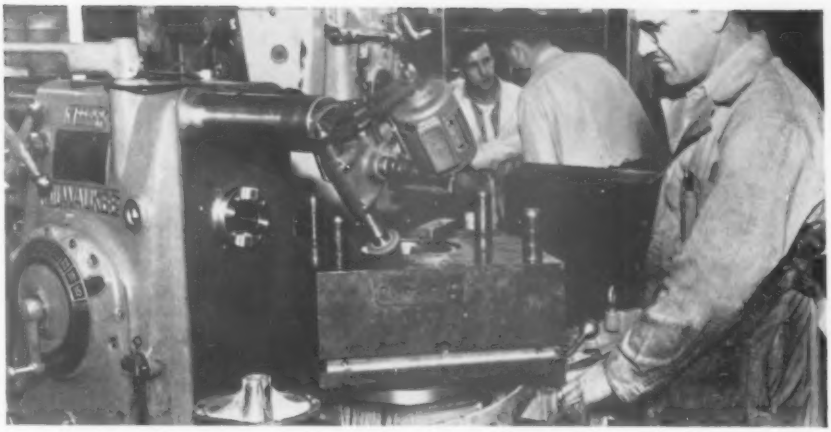
In addition to heavy construction equipment, Jumbo Steel Products Co., Azusa, builds an extensive line of rugged, heavy duty implements especially designed for farming western soils.

Up in Tacoma, Wash., the John Deere-Lindeman Co. builds a land shaper, integral tool carrier, and other tractor-drawn agricultural implements. In the same city, Edwards Equipment Co. makes beet loaders and orchard trailers.

The Boyle Manufacturing Div'n of the U. S. Steel Products Co. at its Los Angeles plant maintains a force of 450 employees to produce about 500 diversified products, including a complete line of gardening implements and many types of steel containers.

Supplying Industry

Providing the rest of industry with the machines, the tools, the mechanical and hydraulic components, and other similar essentials for production are countless tool and die shops, stamping plants, and other subcontractors, together with a large number of manufacturers of specialized products.



At McCulloch Motors Corp'n, 24-lb. vertical shaft engines—for lawn mowers, vertical pumps, and other West Coast products—are built with great precision and care. Above, a Milwaukee milling machine has been temporarily adapted with a grinder head, making use of the mill's rotary table. The die shown will be used in a 3G Reed-Prentice machine for die-casting a 3 lb., 3¾ oz. engine crankcase. The part requires a four-piece die, with three inserts, and four separate draws.

To name a few of these manufacturers: American Drill Bushing Co., Los Angeles, producing a complete line of bushings and liners; Engineering Products Co., Los Angeles, heavy duty cylinders; General Controls, Glendale, a complete line of automatic pressure, temperature, and flow controls.

Hufford Machine Works, Redondo Beach, stretch-forming and other specialized hydraulic machinery; Pacific Screw Products Corp'n, South Gate, automatic screw machine parts; Pacific Gear & Tool Works, San Francisco, gear motors distributed by General Electric; Marlsborg Manufacturing Co., Oakland, steam cleaning machines; and Anti-Friction Bearings Co., Los Angeles, self-aligning pillow blocks and flange units.

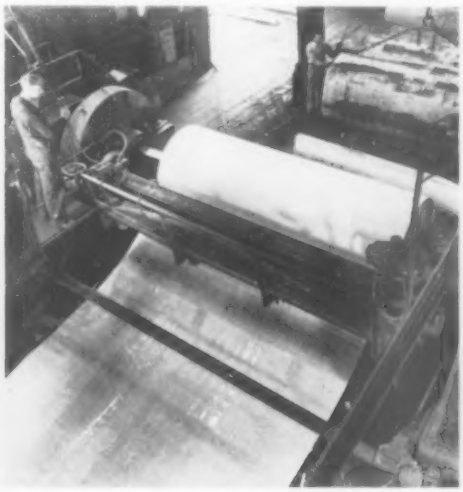
And among the subcontractors are found these typical firms: Torrance Brass Foundry, Torrance, where their methods in centrifugal casting have attracted wide attention; Norris Stamping & Mfg. Co., Los Angeles, whose large stampings and porcelain enamel finishing work includes housings for the Thor Automatic washers and bath tubs for Sears; and Erie Manufacturing Co., Belmont, turning out 10,000 steerling column assemblies a month for Ford Motor Co.

Among manufacturers serving other industries are Hallett Manufacturing Co., Inglewood, making marine diesel engines, diesel electric generating sets, diesel pumping units, and a complete line of low h.p. diesel engines . . . used in practically every western industry, as well as being sold to a large export market.

Yuba Manufacturing Co., San Francisco, and Benicia, builds giant dredges for the construction and mining industries, while Peterbilt Motors Co. of Oakland turns out custom-built trucks.

It is beyond the scope of this short article to completely cover all industry; rather, it has been necessary to pick out a few to show the development of a closely integrated purchasing, manufacturing, and distributing economy on the Pacific Coast.

The preparation of this article has been possible only through the splendid cooperation of numerous manufacturers, associations, chambers of commerce, and governmental agencies. Their assistance is appreciated.



Modern heavy materials handling equipment is widely used in the Pacific Coast lumbering and forest products industries. The winch and arch shown at left, above, is made on the Coast by Hyster Co. In this instance the arch delivers about 55 M bd. ft. to the loader, on a 4000-ft. haul at 5000 ft. altitude. Next is shown a giant lathe, at a Portland, Ore., plant, removing the thin veneer that will be made into plywood. Last is a view in the Oregon-Washington Plywood Co., Tacoma, Wash., where panels from glue spreaders (left) are moved by table conveyors to the newly-installed hot-plate presses. The press shown is a 20-opening 60" x 120" Williams White, with automatic loader and underloader by American Manufacturing Co.

A·S·T·E· NEWS

Society Offers 4½% Bonds

A FINANCING PLAN, adopted by the Special Housing-Finance Committee at their meeting in Detroit, July 10, calls for issuing investment bonds, bearing 4½ per cent interest per year, in denominations of $100, $500 and $1000. They are to be redeemed in 10 years, but the Society reserves the right of redemption at any time after one year.

These bonds will be sold only to Chapters and members, but will be transferable to other Chapters and members in good standing.

In announcing the issuance of the first series of ASTE bonds in the Society's history, Irwin F. Holland, Society President, said: "Nowhere in present day business and financing can I think of another place where a gilt-edged investment paying as high as 4½ per cent interest can be made. The Society's current rent and other expenses attendant to doing business in its present location will easily amortize and retire the proposed bonded indebtedness.

"We suggest, therefore, that all Chapters with surplus funds and endowments and all members who have moneys to invest, whether the amounts are large or small, make an immediate investigation of this ASTE bond issue. An amount as small as $100 may be invested and all denominations may be had in multiple units."

The officers express keen interest in seeing these bonds spread as widely as possible among the Chapters and rank and file of the Society's membership.

Interested Chapters or members may return the coupon below for further information and details concerning this bond issue.

The new Central Office building, for which the Board of Directors appropriated $160,000, is already under way on Puritan Avenue in northwest Detroit. Details of its construction and use were reported in the July *ASTE News*. It is expected that the structure will be ready for occupancy late in October.

Modern Handling Methods Speed Plane Maintenance

San Francisco, Calif.—A push button maintenance dock embodying a system of suspended metal catwalks to completely surround a DC-6 so that it can be moved into a hangar and readied for the overhaul crew in minutes instead of hours, is one of the most spectacular features of a new, airline maintenance base at the Municipal Airport here.

So Golden Gate members observed during a recent tour of the United Air Lines plant where 11 airliners can be overhauled simultaneously.

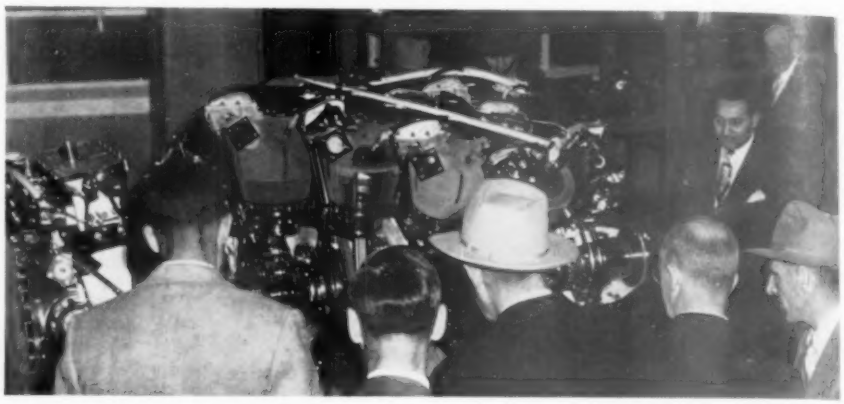
Engines are moved on engine-mount dollies to the power plant department. After steaming to remove superficial grease and dirt, the engines are disassembled and parts strung along a 1280-foot overhead chain conveyor, then immersed in a five-hour detergent bath.

Elsewhere, cylinders and other parts are tested for flaws and wear. After reassembly, the engines are taken to a test cell building to be run in before being recertified.

Meanwhile propellers, radio equipment, instruments and electrical devices are overhauled and checked. Electro plating, welding, tire and other shops contribute to the big maintenance operation.

The color scheme, combining shades of blue, green and gray, also impressed the visitors.

Before the tour the 170 members and guests had dinner at the plant cafeteria. James G. Percy welcomed the group for the management.



A group of Golden Gate members admire a cutaway model of the new 28-cylinder 3400-h.p. Pratt & Whitney aircraft engine during a Chapter tour of the United Air Lines maintenance base at the San Francisco Municipal Airport

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AMERICAN SOCIETY OF TOOL ENGINEERS

1666 Penobscot Building

Detroit 26, Michigan

Please send me complete information on the ASTE investment bond issue.

Name .....

Street and Number .....

City ..... Zone ..... State .....

PRINT NAME AND ADDRESS PLAINLY

Turn back to insert facing pages 32 and 33 for handy reservation cards for 16th Semi-Annual ASTE meeting in Los Angeles this Fall. Fill out these cards today and mail promptly if you are planning to participate in this great event.

ntown Golfers Defeat vidence Opponents

ston, Mass.—Some 225 members guests participated in the day-long ities of Boston Chapter's annual g. June 12, at the Marlboro Country Headed by "Jack" Ewer of Nor- Co., Arrangements Chairman, the t began at 9:00 A. M. and continued after midnight.

ggy weather did not deter the golf icts, 135 of whom waded through y grass to strive for a prize, while a ked local team soundly trounced ting contenders from Little Rhody apter. For the non-golfers, such in- diversions as card games and refreshments helped to pass the morning.

The afternoon program, featured sports activities directed by Ralph Rob- ins of Anderson-Nichols Co., who piloted a softball team from the north of Boston, defeated at the hands of South Bostonians captained by "Jim" Leone of Chelsea Clock Co. A horseshoe pitching tournament ended with such confusing results that no winners could be posted.

Dinner taxed the Club's seating capacity, the overflow crowd being served at Wildwood Inn about a mile away. But all returned to the Marlboro for the awarding of sports equipment, lighters and other prizes galore. A lively floor show followed.

Controlled Air Power A Tool of Industry

Fond du Lac, Wis.—Approximately 100 members of Fond du Lac Chapter heard J. James Mudd of The Bellows Co., Chicago, Ill., describe applications of compressed air as used in the machine tool and other industries, in a slide-illustrated address, June 11.

A film of the Green Bay Packers football team, and a business meeting completed the program. Jule P. Schommer, Chairman, presided.

Attendance included four Past Chairmen: K. F. Gallimore and W. E. Rutz of Fond du Lac, A. F. Schroeder of Oshkosh, L. J. Kaufman of Manitowoc.

Seattle Wins State Recognition for T.E. Profession

Seattle, Wash.—A Professional Tool Engineer License classification has been established by the State of Washington, through the efforts of Seattle Chapter, ASTE.

When first approached a year ago, the State Board of Professional Engineers was of the opinion that mechanical engineering covered the phases of tool engineering, but expressed interest in learning more about the latter field.

So a special Committee on Registration of Professional Engineers was appointed by then Chapter Chairman Gordon Munro to seek separate branch recognition for tool engineering. Co-chairmanned by John Goodrich and Vincent Dornes, the Committee, composed of H. R. Pinkerton, Charles Dreiling, and W. G. Meissner, plunged into extensive research on the background of the problem.

In addition they worked tirelessly in contacting members of the State Board, educators, the ASTE National Education Committee and National Committee on Professional Engineering.

Comprehensive Brief Prepared

A model of clarity and thoroughness, the brief they prepared outlined the work of the tool engineer, his education and training; it drew lines of demarcation between tool engineering and other branches of the profession; and examined in detail requirements of the tool engineer against degree courses given at the University of Washington.

While the document was being studied by the Board, the Committee attended open meetings of the Department of Licenses. Success rewarded their enterprise when the State recently rendered a favorable decision, granting their petition for professional recognition.

Taking advantage of the new license classification, a number of Seattle members have already applied for and received Professional Tool Engineer licenses. They are: M. L. Basinger, F. L. Coenen, J. E. DePhelps, V. A. Dornes, C. A. Dreiling, J. G. Goodrich, A. V. Matuschak, K. F. Melde, C. A. Peterson, H. R. Pinkerton, B. J. Storey, E. J. Valcourt and E. C. Williams.

Other Chapters interested in promoting similar legislation may obtain further information on Seattle Chapter's procedure by contacting W. A. Dawson, Chairman, ASTE National Committee on Professional Engineering, 154 Dalewood Crescent, Hamilton, Ont.

Richmond Chapter presented its annual engineering scholarship of $100 to John H. Barker of Whitewater High School during June meeting of Chapter. From left: Ralph McKee, Chapter Chairman; Mr. Barker, Gervus D. Miller, his principal at Whitewater, and L. B. Penland, Education Chairman and a Past Chapter Chairman

Jule P. Schommer, Fond du Lac Chapter Chairman, introduces J. James Mudd (left) of The Bellows Co., technical speaker at a recent meeting. H. L. Whitman (center), also of The Bellows Co., is a Chapter guest

Whitewater Youth Wins Richmond Scholarship

Richmond, Ind. — John H. Barker, Whitewater High School graduate, was awarded the annual $100 engineering scholarship of Richmond Chapter at a dinner meeting, June 8, in the Leland Hotel.

Mr. Barker, accompanied by his principal, Gervus D. Miller, received the scholarship from L. B. Penland, Chapter Chairman. The award winner will enter Purdue University in September.

Technical speaker was Howard J. Stagg, Metallurgical Specialist, Crucible Steel Co. of America, Syracuse, N. Y. His highly informative talk on Tool Steels and Tools was leavened with humor.

A correctional program to promote traffic saftey was outlined by Eugene Juerling of the Richmond Police Department, who cited alarming statistics on traffic accidents and deaths.

Golf Heads Outing Sports

Milwaukee, Wis.—An all-day golf tournament was the main event of the annual outing held by Milwaukee Chapter, June 5, at Lakeside, Pewaukee.

Many among the 65 members present participated in other sports on the program.

Awards were made to blind bogey winners and a drawing was held for door prizes. A buffet supper concluded the recreational event.

Smiles of victory light faces of members of winning softball team at Boston Chapter's June outing. Standing, from left: J. B. Savits, umpire; R. J. Antonellis, John Parker, James Horrigan, S. Benedetto, Malcolm M. Stone, John Sylvester and Fred Nolan; kneeling; Francis E. Ward, A. J. Leone, captain, and Nichodemas McGillicuddy

Institute Awarded Certificate at 'Hartford Night'

Hartford, Conn.—Before an audience of more than 400 members and guests of Hartford Chapter, the first New England educational institution offering a tool engineering course conforming with ASTE standards was awarded the Society's Certificate of Approval.

Commending the school on its activities, W. F. Jarvis, Chapter Chairman, presented the certificate, on behalf of the National Education Committee, to Carmelo S. Greco, Supervisor of the Connecticut Engineering Institute, during the Chapter's annual Hartford Night dinner held June 7 at Hotel Bond.

James Y. Scott, President, Van Norman Co. and Morse Twist Drill & Machine Co., gave the principal address. Describing a recent visit to Belgium, France and England, Mr. Scott predicted that Britain will recover her past glory, build up production, and develop self-sufficiency.

Other speakers were Governor James C. Shannon, Mayor Cyril Coleman, and ASTE President Irwin F. Holland. V. H. Ericson, Third Vice-President, was toastmaster.

Entertainment followed the speaking program.

Speakers' table guests included: M. J. Mather, V.-Pres., The Allen Mfg. Co.; S. F. Wollmar, Pres., Hartford Empire Co.; Marshall Jarvis, Pres., The Charles L. Jarvis Co.; V. L. Haag, V.-Pres., Gray Mfg. Co.; J. T. Bunce, Factory Mgr., Pratt & Whitney Aircraft; H. P. Cleaver, Works Mgr., Fuller Brush Co.; H. H. Richardson, Pres., The Spencer Turbine Co.; R. M. Terry, Secy. and Gen. Mgr., The Abbott Ball Co.

L. B. Stoner, Pres., Jacobs Mfg. Co.; J. D. Murphy, V.-Pres., The Wiremold Co.; F. U. Conard, Pres. and Gen. Mgr., Niles-Bement-Pond Co.; Erle Martin, Gen. Mgr., Hamilton Standard Propellers; R. J. Ahern, Pres., The Billings & Spencer Co.; David Ayr, Pres., The Hendy Machine Co.; W. C. Stauble, V.-Pres., The Holo-Krome Screw Corp.; C. S. Parsons, N. E. Mgr., J. K. Smit & Sons, Inc., and D. B. Huntting, Pres., The E. Horton & Son Co., First and Second Vice-Chairman of the Chapter, respectively.

Coming Meetings

AKRON—September 13. Speaker: George Edgerton, Lincoln Park Industries. Subject: "Design of Carbide Dies."

BUFFALO-NIAGARA FRONTIER — Annual Stag Outing, September 11, Walker's Grove.

ELMIRA—August, Annual Outing. September 13, 7:00 P. M., Mark Twain Hotel. Speaker: Earl W. Daugherty, Whitman and Barnes Co., Chicago. Subject: "Drill and Reamer Applications."

FOND DU LAC—August 15, Sherwood Country Club, Green Bay, Wis. Annual Summer Outing for members and friends. Golf, baseball, cards, children's games.

LOS ANGELES—October 11, 12, 13. ASTE 16th Semi-Annual Meeting, Hotel Biltmore.

TOLEDO—September 8, 7:00 P. M., Toledo Yacht Club. Speaker from Carboloy Co., Inc., Detroit, Mich. Subject: "The Tool Engineer's Opportunity and Responsibility in Connection with the Use of Carbide in Present Day Industry."

TWIN STATES—Annual Outing, September 18, Windsor Country Club, Windsor, Vt.

217 Caper at Frolic

Toledo, Ohio—A warm clear day among several rainy ones favored Toledo Chapter for its Annual Spring Frolic at Highland Meadows Golf Club, June 10.

Activities began at noon for the 120 competing golfers, with refreshments available on the course. First prize for low gross score was a handsome golf bag, won by David Heinle with a 73.

After dinner more than 50 door prizes, including cash, clothing and tools, were awarded to lucky ticket holders. The grand prize, a 65-pound porker, went to Ralph Temple. Fred Ahrendt was the winner of a set of golf irons.

A floor show climaxed the day's entertainment. Ralph Ford was in charge of the Frolic, attended by 217.

Announcements of Coming Meetings should reach *The Tool Engineer* two months before date of meeting.

ASTE Design Students See Plant Production

Philadelphia, Pa.—A plant tour and lecture at the local Link-Belt works was sponsored recently by Philadelphia Chapter for students in their Tool, Die, Jig and Fixture Design evening classes at Spring Garden Institute.

Educational tours of this type are arranged and encouraged by the Chapter, in conjunction with local industries, to acquaint students with modern manufacturing methods and the newest tooling techniques for mass production.

At the Link plant, the 103 visiting students learned, 50 or more pieces are considered a production run, air chucks and clamps, arranged for flexible changing, are in general use; each machine has a plentiful coolant supply, and there is adequate horsepower for machine tools.

Jigs and fixtures are made outside, and carbides are used extensively. Inspecting is done at the machine, with final inspection reduced to a minimum.

To eliminate unnecessary handling, raw stock is centrally located.

Many supervisors for this and other company plants are drawn from graduates of the five-year student training program. Between shop and office personnel, good cooperation has been developed.

The two and one-half hour tour included the turret lathe, milling, grinding, gear cutting, welding, tool crib, plate fabrication and assembly departments. It was conducted by Roy S. Paulsen, Supt. of Machine Shops and Tool Engineering, and Second Vice-Chairman of the Chapter; and Emil Kitzman, Chapter First Vice-Chairman, assisted by plant personnel.

Squibb, Chief Engineer

Detroit, Mich. — Appointment of George R. Squibb, Cincinnati ASTE member, as Chief Engineer of Detroit Broach Co. is announced by Gustav von Reis, President.

Since graduating in Mechanical and Aeronautical Engineering from the University of Michigan in 1933, Mr. Squibb has been employed by Cincinnati Milling Machine Co., Cincinnati, Ohio. Specializing in broaching for the past 10 years, he has lectured before technical groups.

Left: A group of students from the ASTE classes at Spring Garden Institute, Philadelphia, get closeup of drilling operation during tour of the Link-Belt plant there. Right: W. F. Jarvis, Hartford Chapter Chairman, presents Society's Certificate of Approval to C. S. Greco, Supervisor, Connecticut Engineering Institute, first New England technical school to qualify for award. From left: I. F. Holland, President; Richard A. Smith, Education Chairman; Mr. Jarvis; Frederick Woodcock and Mr. Greco

Situations Wanted

FIELD OR SALES ENGINEER—Registered professional engineer, B. S. in M. E.; 12 years shop and on board as machine designer. Experienced in processing, interchangeable manufacture, special machine problems, handling methods, and engineering vital to establishment of contracts for sale of production equipment. Excellent references. Please reply Box 147, American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Mich.

PLASTICS PRODUCTION EXECUTIVE—Experienced in setting up and supervising plastic mold shop. Background includes supervision of plastics laboratory, plastic mold making; gage designing, making, consulting; tool and instrument making. Assisted in developing sound and color on film. Served apprenticeship at Ford Motor Co. Please address replies to Box 148, American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Mich.

SALES ENGINEER, with 13 years' experience in design of special machinery and tools, material handling, and cost estimating, desires to locate with progressive concern. Age 38, married, two children. Preferred location, Ohio or Indiana. Salary $8,000 to $10,000. Please address Box 146, American Society of Tool Engineers, 1666 Penobscot Bldg., Detroit 26, Mich.

Outing Filmed in Color

Toronto, Ont.—Under azure skies, Toronto Chapter held its Ninth Annual Field Day, June 18, at the Elms Golf and Country Club. At least 380 members and friends, many from out of town, enjoyed themselves playing golf, baseball, and horseshoes.

Sports events and other highlights of the day were recorded in a color motion picture for showing during the winter months. Later the film will be made available to other Chapters.

D. R. Cooper arranged the outing.

Mattern Leaves Vulcan

Dubois, Pa.—J. F. Mattern, of Pittsburgh Chapter, has resigned his position of Vice-President, General Manager and Treasurer, Vulcan Soot Blower Corp., to resume management consulting service.

New Equipment to Reach 20,000-Foot Oil Wells

Toledo, Ohio—Equipment now being built will gnaw 20,000 feet into the earth in the ever-deepening quest for oil, H. E. Heywood, Jr., Engineer for National Supply Co., informed nearly 100 Toledo Chapter members, in a recent discussion of "Oil Well Drilling" at the Toledo Yacht Club.

Wells up to 17,000 feet deep have been drilled with rotating bits, while the original cable tool or percussion method is still used to tap pools less than 3000 feet below the surface, said Mr. Heywood.

Construction of drills and such complications as deflecting the drill to reach under an area to an otherwise inaccessible well, and the hazards of recovering lost drills were also described.

Other points touched on by the speaker included the turntable to rotate the drill, the drawworks to control it, and importance of the drilling mud, which serves as coolant for the drill, helps to control dangerous gas, oil, and water pressures, and plasters the bore while returning to the surface laden with rock fragments.

The complete process from prospecting to well operation was shown in a film.

In tracing the history of the oil industry, Mr. Heywood quoted an estimated reserve of 21 billion barrels in the U. S., 60% of it in Texas.

Coffee speaker was Captain Anthony Bosch of the Toledo Crime Prevention Bureau. In Toledo, he stated, juvenile delinquency has been declining since 1943, but, as in most large cities, there is an alarming increase in adult sex offenses.

Diesel Plant Visited

Madison, Wis.—An afternoon tour of the Fairbanks-Morse plant at Beloit preceded a dinner meeting at the Parker "51" Club Shack at Janesville, attended by a large number of Madison Chapter members, June 8.

Highlighting the plant visit was the machining, assembly and testing of opposed piston Diesel engines, as well as operations of the locomotive assembly and forge shops.

Bennett, Brown Capture Rockford Golf Prizes

Rockford, Ill.—After a lapse of several years, a perfect June day shone on Rockford Chapter, on the 4th, for their 12th Annual Summer Stag.

Over 100 ASTE'ers, prospective members, and guests participated in the afternoon golfing over the beautiful but tricky 18-hole Mauh Nah Tee See Country Club Course. More than one golfer found the scenery, a winding creek, hill, and rolling greens, quite a problem. Prizes were distributed on basis of the Peoria System in which everybody has a chance. Paul Bennett won first low net and George Brown had low gross.

Between golfing and the dinner hour, a casting contest was held, Leo Reuland taking first prize, and Leonard Johnson coming in just behind him. Lyle Atwood walked off with top honors in the game of darts.

Approximately 160 sat down to dinner at the country club. After the meal Kenneth Lund, acting as master of ceremonies, distributed some 100 attendance prizes, including a 5-tube, table model radio, several automatic coffee makers, a ¼ h.p. electric motor, and a fountain pen. Leonard Johnson won a 15-jewel wrist watch as grand attendance prize.

Cross Appoints Lesman

Detroit, Mich.—Robert W. Lesman has been appointed Sales Engineer in Indiana for the Cross Co., Ray Morrissey, Vice-President in Charge of Sales, has announced.

A member of Detroit Chapter, ASTE, Mr. Lesman joined the Cross Company in 1946 after wartime service as Naval Officer in Charge of the Inspection Gage Design Dept. of Fisher Body Plant 23.

Austin Elected V.-P.

Detroit, Mich.—W. S. Austin, Sales Manager of LeMaire Tool & Mfg. Co., Dearborn, Mich., and a Detroit Chapter ASTE member, has been elected Vice-President, according to announcement by Wayne Sinclair, company President.

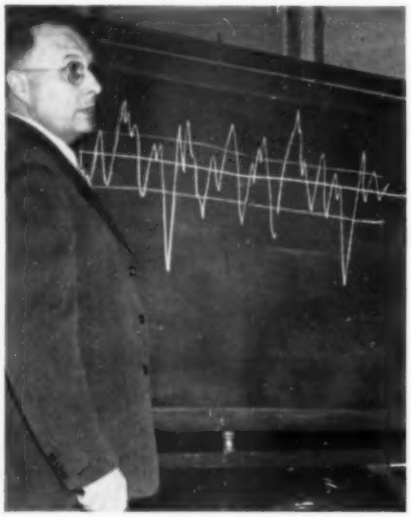
Canadian Chapter Executives Confer at Toronto

Attending the June 5 Regional Meeting of Canadian Chapters at Royal York Hotel, Toronto, are from left, standing: W. A. Thomas, Windsor; G. W. K. Clark, Montreal; F. R. Crook, Toronto; H. B. Ward, Hamilton; L. J. Hollo and J. T. Dilly, Toronto; W. G. Copp and W. M. Shaw, Hamilton; J. B. Burk, Toronto; George Gilmour, Hamilton; L. G. Singer, Toronto; W. L. Sandham and C. D. Wright, Niagara District Chapter; seated: Gordon Hall, Hamilton; G. S. Clarke, Montreal; H. E. Conrad, Executive Secretary; V. H. Ericson, Third Vice-President; W. A. Dawson, Chairman, and Mrs. Harland, secretary of the conference; W. W. Appleton, Toronto; and last man, unidentified

Need for Finer Finishes Brings Measuring Accuracy

Philadelphia, Pa.—Recognition of the importance of surface finish specifications and measurement by engineers and designers has resulted in the development of instruments to accurately measure, on the job, surface roughness in millionths of an inch.

One of these, the Profilometer, was described by E. J. Abbott, Chief Engineer of Physicists Research Co., Ann Arbor, Mich., in a lecture given lately before some 150 Philadelphia Chapter members in the Engineers Club.



Peaks and valleys of surface roughness are graphically illustrated by E. J. Abbott of Physicists Research Co., while lecturing on "Surface Finish Specification and Profilometer Measurement" at Philadelphia

The rugged, portable electronic device, Mr. Abbott explained, consists of a tracer moved manually or mechanically over the surface being measured. Diamond-pointed, the tracer rides lightly over the work, whether flat, cylindrical or curved, its vertical movement converted into a small, fluctuating voltage. The amplifying unit is enclosed in a case and connected to a meter on the panel for rating.

Heights of surface irregularities serve as the basis of roughness ratings. Individual peaks and valleys are seldom important. The average value over ⅛ inch or more of surface provides the practical roughness rating. This running average is automatically computed and read directly from the meter calibrated in micro-inches.

The speaker showed how finer surface finishes of carbide cutting tools eliminate grinding of part pieces. Lantern slides and an actual demonstration of the instrument highlighted the talk.

Prior to the technical session, a film, "Magazine Magic," released by the Curtis Publishing Co., showed the production of large, general circulation periodicals.

Albert B. Luecke was named Membership Chairman to succeed John P. Clark, Jr., who resigned because of increased business activities. An addition of 30 new members, two affiliate members, and two transfers, since the previous month, was announced. Mr. Watson, Chief Engineer of Link-Belt Co., and George Anderson, a transfer from Detroit Chapter, were introduced.

Samuel R. Boyer, Chairman, reported on the Regional Meeting at the Bellevue-Stratford Hotel. Plans for the September Executives Night were also announced.

William Chalfont, Entertainment Chairman, rendered solos and led group singing during dinner. Byron Gates, Secretary, offered the invocation.

Staroba, District Mgr.

Chicago, Ill.—Appointment of Frank J. Staroba, to the position of Midwestern District Manager with headquarters in Chicago, has been announced by K. R. Beardslee, Vice-President and Marketing Manager of Carboloy Co., Inc., Detroit. He succeeds Walter D. Bronson of Chicago Chapter, who recently resigned to form his own company.

Mr. Staroba, a Milwaukee ASTE member, has been with Carboloy for 11 years.

Flanders Aids Audience In Grinding Problems

Louisville, Ky.—Ernest V. Flanders, Chief Engineer, Thread Grinding Div., Jones & Lamson Machine Co., Springfield, Vt., and a Twin States ASTE member, was guest speaker, June 9, at a dinner meeting of Louisville Chapter, held at the Kentucky hotel.

In a discussion of "Thread Grinding," Mr. Flanders used slides and motion pictures complete in every detail. Well versed in shop practices, the speaker showed numerous jobs completely tooled, and assisted members of the audience in their grinding problems.

John A. Black, Chairman, presided over a business meeting and introduced new members. N. H. Booker, First Vice-Chairman, presented the speaker and conducted the technical session.

Forty members were present for the dinner meeting and 75 attended the technical session. The next meeting will be held in September.

Obituaries

Louis M. Neilsen

Louis M. Neilsen, 57, Special Assistant to the River Works Manager, General Electric Co., West Lynn, Mass., passed away May 10 at Salem Hospital, following a short illness soon after his recovery from a serious sickness suffered last year.

Born in Denmark, Mr. Neilsen received his technical training in Copenhagen and through extension courses at Columbia University, New York.

He joined General Electric at Schenectady in 1913, became foreman in the refrigerator division, then general foreman of industrial control. Transferring to the River Works in 1941, he was associated with the supercharger division. Two years later he went to the turbine division as assistant of manufacturing problems. In 1945 he was appointed to the post he held at the time of his death.

For years he had been prominent in Boston Chapter, ASTE, where he chairmanned the Standards Committee. A contributor to trade publications, he was also a member of the River Works Superintendents' and Foremen's Association, First Congregational Church of Swampscott, and Clarence Yates Lodge of Masons at Schenectady, N. Y.

Thomas C. Vittetow

Thomas C. Vittetow, President of Vittetow, Inc., Denver, Colo., and a charter member of Denver Chapter, ASTE, passed away April 2, three days after his 42nd birthday.

Born in Henderson, Ky., Mr. Vittetow attended the public schools of Columbus, Ind. He received his technical education at Georgia School of Technology, a technical school in Maine, and Dobe Engineering School. He was a graduate of the latter institution.

From 1943 to 1945 he served in the U. S. Army. A former member of Cincinnati Chapter, Mr. Vittetow was First Vice-Chairman of Denver Chapter during the 1947-48 term and Chairman of the incumbent Industrial Relations Committee.

Gosta Norlander

Gosta Norlander, 34, President of Wedevags Bruck A. B., Vedevag, Sweden, and an At Large member of ASTE, lost his life May 31 in a British airplane accident over Gothenberg, Sweden.

Mr. Norlander founded his company in 1942 soon after graduation from the Royal Technical University in Stockholm with an M.E. degree.

He was a member of the Swedish Society of Engineers in Stockholm, Eskilstuna Technical Society, and of the Society of Swedish Engineers, Detroit, Mich.

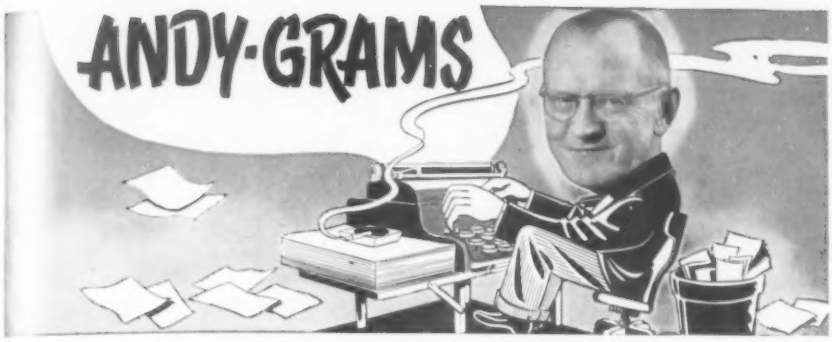
David O. Hunter

David O. Hunter, 60, died May 2 at his home in Stony Ridge near Toledo, Ohio, after an illness of one year.

Born in Sandusky County, Ohio, he had lived in the Toledo area for more than 30 years. After a varied industrial experience, he joined Willys-Overland Motors, Inc., as an estimator early in World War II and served in that capacity during most of the war program.

In December of 1942 he joined Toledo Chapter, ASTE, and was active until incapacitated by his last illness.

Due to failing health he had operated an inn for the past two years at Stony Ridge.



During the summer, I've had to refuse various invitations to attend ASTE outings, clambakes and what have you a/c pressure of work, but, "all work and no play making Jack a dull boy," I finally tore loose and drove out to Detroit Chapter's stag outing at Indianwood Golf Club our Lake Orion way.

No, I didn't play golf, the clubs I won last year (as a door prize) still reposing in their gloves. Y'see, I'm saving golf for my old age, in the meanwhile getting exercise from more bucolic diversions—like weeding my garden and such. Instead, I pitched horseshoes with Fred Hebert, Otto Mueller, Paul Darling and Watt Shelly, the later two spelling Otto and Fred a/c the tough pace I set.

I'd have done all right even if it was the first time I'd played, only those danged professionals ganged up on me. My horseshoes must have been equipped with ball bearings—rolled all over the lot. Later on, with George Koch's help, they took me for a ride in a quieter diversion—and I thought I knew all about that game! However, I won a golf ball and had a good time to boot.

Y'know, there's a lot of work put onto a committee when staging a party of this kind, and while I didn't get to know who the spark plugs were for this event, they deserve credit for a swell job. Anyway, the party was typically ASTE with its good fellowship and I'd say that the same spirit would have prevailed in an outing of any of our four-score or so Chapters. And from now on, I'm going to try to get out with the boys a bit oftener. Thanks for a good time!

Ordinarily, I'm not one to put off 'till tomorrow what's to be done today although, when the grist comes too fast for the mill, I'll tackle the most important things first. Apropos which I've long deferred delving into a miscellany of papers that have been reposing in a chest ever since my mother passed on a decade or more ago.

But, I was busy, first designing a home, then supervising its building, getting landscaping done and the odds and ends of incidental chores. Then came the war, when a 24-hour day seemed somehow too short in view of the demands on my time, and then this job with The Tool Engineer which, as may be inferred, has kept me reasonably busy.

But, I finally got to it and, during evenings for the past several weeks, I've been reliving the past with *auld acquaintance*, of whom the most have crossed the final threshold but who now assume fresh and vital personalities through their writings. Thus, I am becoming more intimately acquainted with my father, who died when I was four and of whom I have but a fleeting yet clear-cut memory.

I recall a walk through rolling fields, of seeing him supervise the installation of a steam engine that replaced the old water-wheel at his mill, and of waving a last farewell from a receding railroad station as the train bore me southward to the home of my grandparents. A big man, standing 6'-4", and built in proportion. The rest I've had from old friends who remembered him as a kindly gentleman, slow to anger although it seems nobody ever got hurt by leaving him alone.

From him, there are no letters, merely some short notes and a diploma from school attesting to application and a flair for history and literature. Oddly enough, my mother's diploma runs along similar lines. What I did run across, however, was a notebook in which he had penned his views on what the model housewife should be, all in verse and running several pages. A classic, well worth translating and publishing. He must have had quite a respect for women.

A letter from a youngster with a yen for America, and later letters where he is all enthused about the new world; next where he lands his first job and enters night school to learn English. Then a promotion, next, meeting the "one and only" and plans for a home of his own. An invention, with plans to start his own shop, but World War I intervened and so another letter as he was leaving for "over there." Then, no more letters. Period.

Leters from a pioneer in the Northwest, running through fifty years or more. Acquiring land, and clearing it; building a cabin, and barns, and then a "modern" home. Progress! Then, a forest fire that swept everything before it, and building anew; then a tornado, with its havoc, and again a rebuilding. Sons born and raised, and gone to war.

Other letters from a boy gone to sea, touching at many ports and in time to become captain. A casual mention of a hurricane and of days adrift in a lifeboat, then to sea again. And so, between the lines of many letters, one reads of hopes, and aspirations, of battles with the elements as well as mortal enemies, and through them all there runs a thread of tenacity of purpose and stark courage in the face of adversity. It's because of people like that that I've come to like people as a whole.

Letters from my grandfather who, perhaps more than any other being, exerted a benign and lasting influence on my life. A comparatively humble yet prosperous farmer, he was widely read and had a remarkable grasp of world conditions. One thing he taught me was the value of fundamentals. "Know the beginning of things," he would say, "and you can always arrive at an end." And on his farm, with its lush acres, all things had both a beginning and an end; it was sufficient unto itself.

Sure, things were in a more or less colonial stage toward the turn of the century, and people lived by their knowledge of fundamentals. There on the farm, for example, flax was sown—and what a sight that was, fields of blue-flowered flax rippling like wavelets in the breeze! —harvested, retted, spun into thread and, during the long winter evenings, woven into glistening linen.

Wool was sheared, carded, spun and woven into cloth; hides were tanned and made into leather, and when I came over here everything I wore *cap-a-pied*—hat to shoes—had been processed from start to finish right there on the place. And the lessons learned in my boyhood have been applied to advantage many a time since then. Two other things my grandfather impressed on me: "Be honest in all things, and especially, be honest with yourself. For if you are honest with yourself you will be honest with all men." Well, I've found nothing wrong with that credo.

There are, of course, the "modernists" who would scoff at such sentimentality, to call it that, but to me these letters are fraught with a homely philosophy the while they provide a design for good living. And don't get the idea that the people who antedated our present machine civilization didn't enjoy life. It was just that life was different, a bit slower, perhaps, and more tranquil, thereby providing time for matured reflection that eventually resolved into the very luxuries we enjoy today.

Yep, there were giants in those days, too, giants in literature and the arts, in science and invention, in commerce and industry, and the seed they sowed has flourished and become woven into a pattern of living in which even the humblest workingman—here in America at least—can enjoy luxuries denied the nabob of a generation ago. But, those giants knew their fundamentals.

ASTEely yours

Andy

By Rex Heath

Glass "Blanket" for Stretch Forming

Improved Method Cuts Costs and Promotes "Good Housekeeping"

STRETCH FORMING of sheet metal, which implies stretching the metal over dies or forming blocks to produce complicated shapes—as, for example, streamlined structures for airplanes—came into considerable prominence during the war and is now applied to manufacture of consumer goods.

While the method is entirely practical, different materials —aluminum and magnesium, for example—have presented problems that have had to be worked out to suit individual requirements. In the stretch forming of aluminum, for instance, it was found that the material would not stretch properly because of friction set up by pressure between the sheets and the die forms which are used as stretch blocks. This friction, between the surfaces, caused an uneven flow of the material, resulting in an irregular, wavy surface.

To cancel out this condition, the general practice has been to paint both material and stretching block with a heavy coating of grease or graphite, and this method has had the satisfactory result of effecting the desired extension without excessive friction. Unfortunately, however, there is created a rather messy, not to say dangerous, condition resulting from slippery floors and the further consideration of cost in the removal of the grease.

Rubber, substituted for grease in the cold forming of aluminum, has given excellent results and is largely favored for this material. But in hot forming of magnesium—1/3 lighter than aluminum and therefore favored in the aircraft industry—rubber proved to be impractical because it smoked and smudged under the heat.

Spun Glass Supersedes Graphite

A method developed by the Manufacturing Research personnel of the Glenn L. Martin Company, of Baltimore, has been found highly satisfactory for the hot stretch forming of magnesium sheets. This consists of interposing a "blanket" of spun glass, .027" thick, between the metal and the forming blocks.

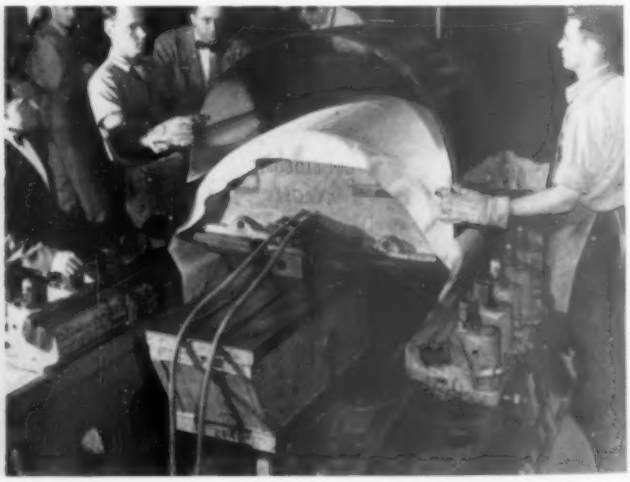
This blanket has the manifold advantage of low thermal conductivity, as between heated sheet metal and the comparatively cold forming block; heat resistance; a delicate tensile strength for the purpose used when drawn tight; a hard, smooth surface which, presented to both material to be formed and the forming blocks, promotes a sliding action between them; and an accompanying passivity, due to the looseness of the weave, which permits it to elongate partially with the metal during the stretch forming operation.

In addition to the practicability of stretch forming heated sheet metal over a cold form, with retarded transfer of and loss of heat from material to form block, it has been found —at the Martin Company—that the use of glass cloth eliminates operations and therefore increases production while, at the same time, it produces more satisfactory parts. There is no specific data, as yet, on the life expectancy of the glass blankets although, as currently used, they indicate marked economies over previous methods.

In stretch forming a magnesium skin $\frac{1}{8}$" × 48" × 72", for example, the time formerly required to spray both part and form block with graphite, and to remove this coating by scrubbing in a chromic acid-calcium nitrate bath, consumed a little over 70 minutes as compared to only about 5 minutes with the use of the spun glass blanket.

The time saved may be more clearly understood by a comparison of methods. For the graphite method, the operations were: 1, spray parts and paint form block with graphite, 5.40 minutes; 2, heat form block to 550° F., 0.20 min.; 3, place skin between pre-heat platens for heating to 650° F., 1.50 min.; 4, remove skin from pre-heat platens and clamp in stretch press, 2.00 min.; 5, stretch form to proper contour, 0.50 min.; 6, remove from stretch block and stack 0.50 min.; 7, remove graphite lubricant and stack, 60.00 min.; or total 70.1 minutes.

With the spun glass method, operations 1 and 7—totaling 65.4 minutes— are eliminated. Operations 2, 3, 4, 5 and 6 are retained at a total of 4.7 minutes, and one operation is added, as follows: Place glass cloth blanket over form block, 0.20 minutes, adding up to a total of 4.9 minutes.



At left, the first operation in the stretch forming of magnesium sheets, using a method developed at The Glenn L. Martin Company, aircraft manufacturers of Baltimore, Md. A thin spun glass blanket is placed over the form block and beneath the sheet to be formed. The glass cloth permits the necessary co-extensive movement of the metal in the forming operation, yet avoids all disadvantages present in the use of graphite as an anti-friction agent. At right, removal of a magnesium part from a stretch press after it has been formed with use of an intervening blanket of spun glass. The substitution for graphite of a woven glass blanket as an anti-friction agent is said to facilitate production, eliminate operations, and to produce more satisfactory parts.

34-91000

Introduction to Cutting Tools

By A. E. Rylander

Installment No. 1 of a Series

DEFINED FOR THE PURPOSE of this Series, cutting tools include all tools that remove metal (or whatever material is being processed) by actual cutting. Thus, planer, shaper, lathe and boring tools; drills, reamers, counterbores and similar; milling cutters; grinding wheels; hones and laps—in fact, everything from straight cutting to abrasives are cutting tools in the sense implied. Attrition tools such as burnishers are not included.

We will discuss these tools in turn, starting with the simplest, which is the planer tool. Planer tools are selected for the initial installment because the straight line motion of the machine provides the easiest visual analysis of what happens under certain conditions of cutting and also because this straight line motion is further applicable to rotary cutting tools which will be discussed later in this series.

That the relationship between straight line and rotary cutting be clearly understood, however, it should be pointed out here that, in rotary cutting, the work is constantly cleared from the tool. The greater the diameter of a part being turned in a lathe, for example, the less the clearance. Inversely, the smaller the diameter, the greater the clearance—that is, for outside diameters. See Fig. 1. Here, the end relief and end clearance angles of the cutting tools are not shown, the intent being to show the clearances effected by the diameters of the work alone.

On planer work, on the other hand, the work itself provides no clearance; therefore, clearance must be incorporated in the tool—as, for that matter, clearance angles must be incorporated in practically all cutting tools. Not only that, but provision must be made so that the tool does not drag on the return stroke.

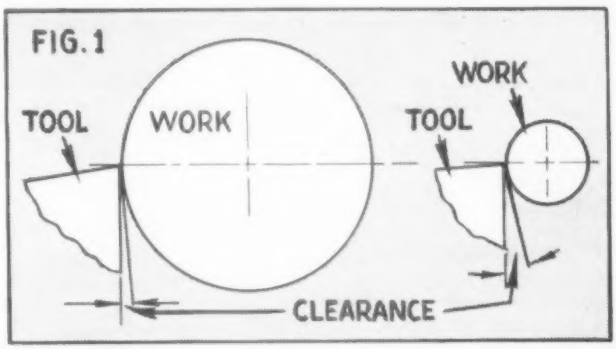
Therefore, the tool head of both planers and shapers is provided with a "clapper" which permits the tool to swing clear from the work on the return stroke. See Fig. 2. On some special machines, however—as, for example, machines designed for planing form and master tools—the table drops away from the cutter on the return stroke.

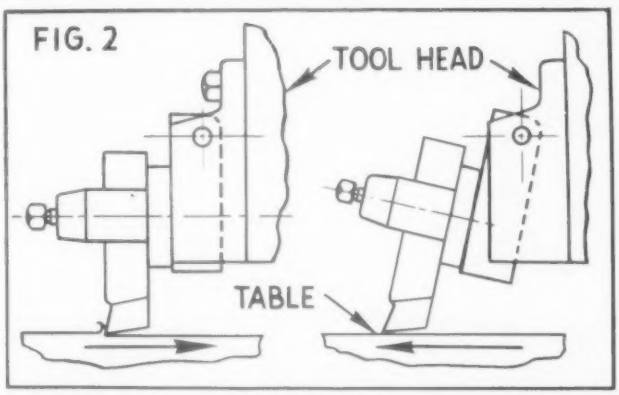
In all cutting operations, it is important that, should the tool "snag" during a cut, it clears away from the work instead of gouging in. While gouging would be more likely to occur during a heavy roughing cut rather than during a light semi-finishing or finishing cut, it could easily happen that a part might be spoiled as a result of digging in below the finished dimension.

In planing or shaping, this gouging cannot ordinarily occur since the tool would spring away and up from the work; if, however, a commercial tool holder is used, with the back rake angle incorporated in the holder itself, then the inserted bit could easily spring enough, under a heavy cut, to cause a serious gouge. However, tools so raked are not ordinarily used in planer work. See Fig. 3, in which—as in most illustrations in this article—conditions are purposely exaggerated.

Because different materials demand different tools with different rake angles—and, in many instances, of different steels and alloys—these are shown in Figs. 4, 5 and 6, with descriptive captions. Fig. 4 shows tools ground with positive rake angles, Fig. 5 tools ground with negative rake angles, and Fig. 6 various tools used in planer work.

For planer work, cutting tools may be of carbon or high speed steel, cast alloys—as Stellite, for example—or any one of the several grades of cemented tungsten carbide, depending on the material to be cut. In general, these tools are not materially different from tools used for lathe work.





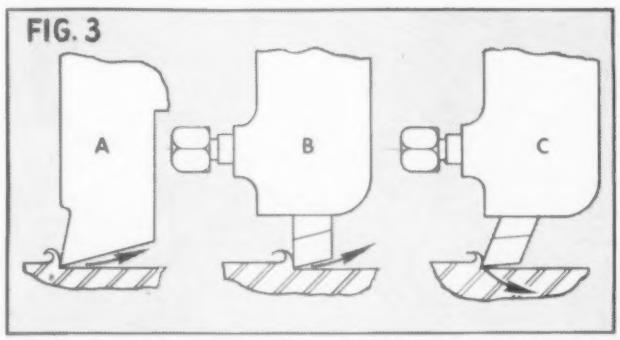


Fig. 1. Showing the relative clearances between end of tool and work on large and small diameters. End relief and end clearance angles are disregarded for purpose of illustration. Fig. 2. Planer and shaper tools are mounted in a "clapper" and swing away from the work surface on the return stroke, as shown at right. The angle of swing is greatly exaggerated

Fig. 3. Tools A and B would spring away and up from the work, as indicated by the arrows; therefore, they could not gouge into the work if both tool and work are tightly clamped. While the body of the tool holder (B) would also spring under a heavy cut, the bit—fulcrumed at point "o"—would spring downward causing a gouge

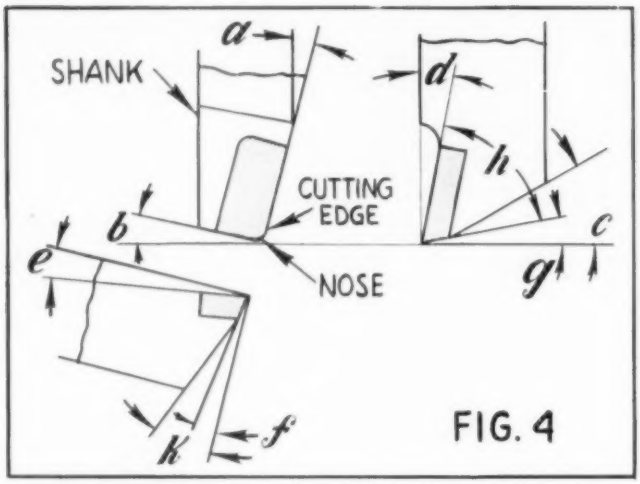


Fig. 4. Rake angles of positive rake cutting tools. a = side cutting edge angle; b = end cutting edge angle; c = end clearance angle; d = back rake angle; e = side rake angle; f = side relief; g = end relief; h = lip angle, and k = clearance (on carbide tools) for grinding of carbide tip

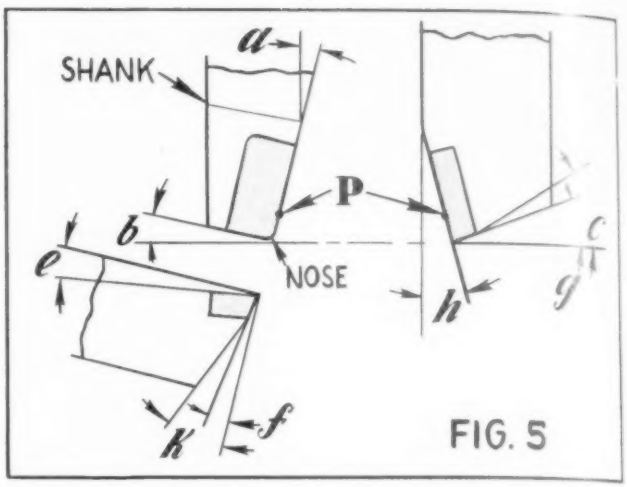


Fig. 5. Rake angles of negative rake tools. Except for rake angle "n", all other angles compare with those designated in Fig. 4. The advantage of negative rake tools is that, instead of the nose breaking away the chip, this load falls at point "p" approximately, or toward the heel of the cutting edge. Angle "n" may vary from 5° to 45°, depending on material and whether continuous or interrupted cut

Since the majority of planer tools are used for side cutting—as, with the cutting edge to the work—tools of the type shown at D and E, Fig. 6, would be most commonly used. However, tool holders with bits, as shown at F (and B, Fig. 3) may be used, as well as carbide tipped tools such as shown in Figs. 4 and 5. Tool F is largely favored because of its versatility and solid grip on the bits.

The tools described above may be used for cast iron, steel or other materials with only slight differences in rake angles. For finish cuts on cast iron, however, a shovel nosed tool such as shown at G is a prime favorite. This tool has a slight radius at the leading edge, then flattens out toward the heel; also, it may be slightly sheared. Both leading edge and heel are well rounded to prevent possible marring of the work. Feed is very coarse—¼" or more per pass—so that the tool takes a wide cut leading gradually from toe to heel; however, the tools produce a very smooth and flat surface if properly ground.

Another finishing tool is shown at H. Here, the cutting edge is slightly back from the top (or front) face of the shank, for springback; however, it may also be made rigid as indicated by the dotted line. Tools of this type may also be used for cut-off or deep grooving. Tool J is used for finishing cuts on steel and, as noted, has a slight convex radius and a slight side relief. In action, it produces a fine curling chip somewhat comparable to the strands of steel wool, from which it may be inferred that the feed is very fine.

Longer Life With Negative Rake

Ordinarily, the surface finish produced with this tool is not as smooth as that produced by tools G and H; however, it will compare favorably with the finish cut produced on a lathe using a sharp finishing tool and a fine feed. Incidentally, these tools are usually made from a good grade of high carbon tool steel, as this close grained metal produces a smoother finish than would ordinarily be obtained with high speed steel.

Slotting tools, for T-slots, are shown at K and L. The leg of the Tee is first cut with tool K, then, the Tee is crossed with several of the tools designated by L. Several of the latter—both right and left hand—must be used since the neck would be too weak if too much stock were to be removed by one tool. The clapper box is locked, when slotting, else the tool would wedge with disastrous results.

One of the many advantages to be gained from use of negative rake tools, shown in Fig. 5, is longer tool life and more pieces machined between grinds. Cutting action is

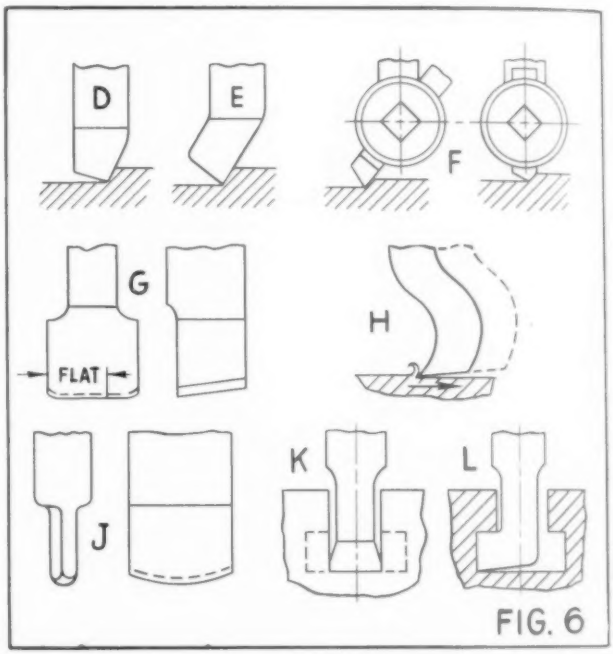


Fig. 6. Straight and left bent planer tools are shown at D and E. They may be made opposite hand as well. A universal tool bit holder, which may be adapted to right or left hand cuts, or vertical, is shown at F. Tool G is used for finishing cut on cast iron, and tool H for finishing cut on steel. Tool J is also a finishing tool, but (made narrow) may also be used as a deep slotting or parting tool, when it should be made springy as shown by solid line. Tool K is for starting a T-slot, while tool L cuts the Tee, right and left tools being used. When T-slotting, the clapper is locked

comparable to shearing, hence, the term "negative rake" is somewhat of a misnomer. The brunt of the cut is taken toward the heel of the cutting edge, as indicated by point "p", Fig. 5, although the exact line of this point would vary with the depth of cut.

Described in simple terms, the chip slides down the incline (angle h, Fig. 6), and around the nose of the tool and down the side rake, "e"; thus, there is comparatively little cratering with these tools although maximum wear will occur at point "p". The negative angle "n" may vary from 5° to as much as 45°, depending entirely on the nature of the work and also on whether the cut is continuous or interrupted.

END OF INSTALLMENT NO. 1, THIS SERIES. Installment No. 2 will follow in The Tool Engineer.

GADGETS

Ingenious Devices and Ideas to Help the Tool Engineer in His Daily Work

Toolholder for Solid Blanks

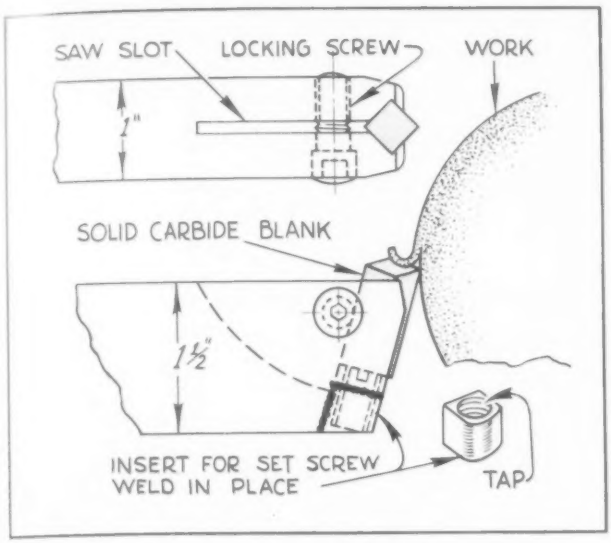


Fig. 1. Single toolholder with steel shank.

A TOOLHOLDER with a mechanical clamp for use with solid carbide blanks can be economically made from a rectangular steel shank, as illustrated in Fig. 1. A square slot is cut in the end of the shank to suit the size of the carbide blank. At the lower portion of the slot an insert is welded in place, as shown, for mounting of the adjustable setscrew. A saw slot and locking screw provide positive clamping of the carbide blank.

Since solid carbide blanks are used, no brazing is necessary for the initial setup. However, as the blanks wear down an extension can be brazed to the underneath end. The holder can be hardened if desired. The blanks can be removed quickly for grinding or replacement, thus reducing set-up time. Grinding of the blank is only required on one face. The design is well suited for steel cutting, since ample chip clearance is obtained, and because chips will not cut into the holder. The toolholder in general is less affected by overhang.

The square slot is milled into the end of the shank as illustrated in Fig. 2. First a slot is cut at an angle of 45 deg., as at A, then a second slot is cut, as at B. A 90 deg. form cutter, shown at C, is used to mill out the remaining portion of the slot. Finally, the saw slot is cut and the hole machined for the locking screw, as at D.

Multiple toolblocks can be made as shown in the lower part of Fig. 2. The center tools are locked in place by means of tapered screws. Other variations of clamping could be provided to suit specific needs. The general proportions of the toolholder can be modified for various sizes of tools, or for different types of operations.

C. W. Frank

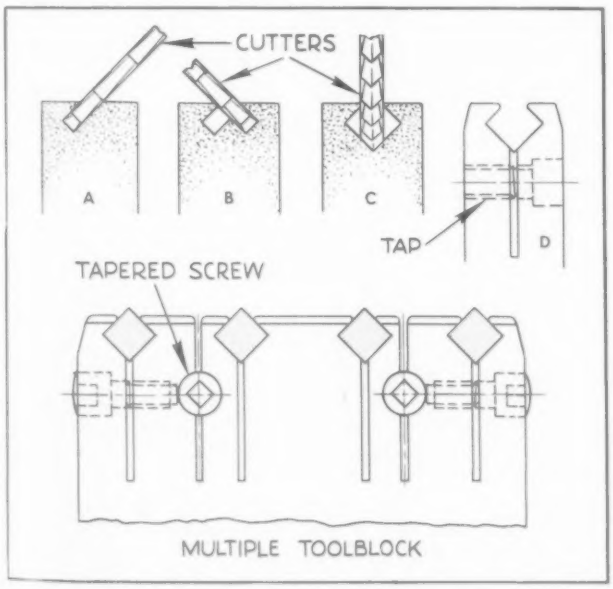
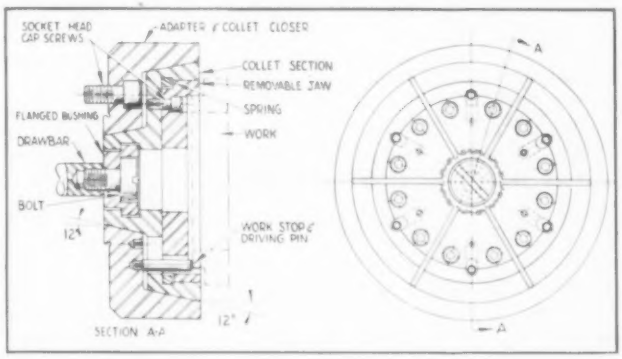


Fig. 2. Method of machining multiple tool block.

Versatile Collet Chuck

IN THE COURSE OF SETTING UP some special purpose, semi-automatic machines, it was necessary to provide collets with changeable jaws. The work, in small quantities and in a variety of sizes, required that close limits of concentricity be held. The chuck shown has been proven entirely satisfactory over a considerable period of time.

Construction is as follows: The adapter and collet closer, which is hardened and ground and provided with a taper of 12° per side, fits the machine spindle and is held to the spindle with six socket head capscrews. The collet sections are also hardened and ground to this same angle.



The collet, with its removable jaw, is draw-bar acuated and closes by being drawn in against the 12° taper of the adapter. The work stops against three of six pins equally spaced, the other three acting as drivers.

The removable jaws are bolted to the collet sections with socket head capscrews. Both the collet sections and removable jaws are slotted for the six work stops and driving pins although, actually, only three of these pins act as work stops. The other three are cut short and act as drivers.

Two sets of tapped holes are provided in the adapter and collet closer for these pins, so that they may be located to suit various work sizes. The spring is a bar of spring tempered steel, and acts to hold the jaws open for loading and unloading the work.

The drawbar extends through the machine spindle and may be operated by air cylinder or mechanical means. This

drawbar is bolted to the flanged bushing, which opens and closes the collet sections and jaws. Note: Be sure to allow enough clearance between the flanged bushing and the collet sections to allow them to close properly.

The collet sections are made by machining, partly cutting into six sections with a slitting saw, and hardening and grinding. After grinding, the sections are cut apart with an abrasive cut-off wheel. The removable jaws can be hardened and ground or left soft, depending on length of the production run. It would be well to number the collet sections and removable jaws in order to always assemble them in the same positions. If carefully made, this collet fixture will give long, satisfactory service, and will handle a variety of work.

Geo. W. Brown
Atlanta, Ga.

Gage For Tapered Diameters

WHILE DIAL INDICATOR GAGES play a prominent part in checking straight inside and outside diameters, they are not frequently used to check angles of tapers of tapered outside diameters. Instead, the old taper ring gage, with steps as shown in Fig. 2, is used extensively. However, this only indicates the accuracy of either the small or large diameter if the taper is incorrect, and furthermore entails "blue testing" which is not only time consuming but depends largely on the inspector's skill and judgement.

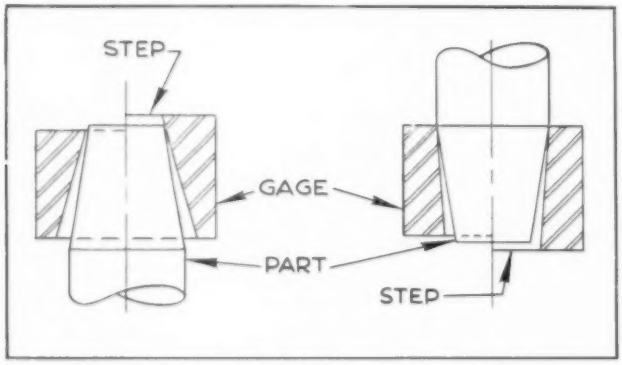


Fig. 1. Tapered gages of this type only indicate accuracy of either large or small diameters, but not of both diameters and correct taper in the same gage.

The type of gage shown in Fig. 2 meets necessary requirements for a taper gage, viz: Direct reading instead of reliance on judgement, easy and fast operation, and dependability. It is merely required to place the part in a V-block and to traverse a dial indicator in its fixed track along the top of the part being checked. If the indicator should then move beyond the established limits, the angle of taper will be known to be incorrect.

When, however, it comes to designing the gage and establishing the angle "b", Fig. 2, at which the Vee groove must be machined with relation to the base, it will be seen that this angle cannot be found readily. Therefore, a formula to ascertain this angle "b" is shown below, set up for a 90° Vee and for a taper to be checked whose included angle is to be 2a.

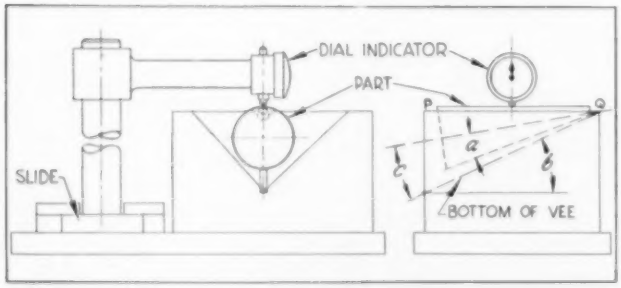


FIG. 2. If the vee groove is cut at the correct angle "b" any deviation from the right taper of the work piece will show as a change in reading on the dial as the indicator is moved on its track, parallel to the center line of the work piece, from P to Q, the indicator being set on the highest point of the workpiece.

$$b = a + \text{secant}^{-1} \sqrt{\frac{\text{cotangent}^2 a + 1}{\text{cotangent}^2 a - 1}}$$

Example: Included angle = 20°, therefore a = 10°
Now:
cotangent 10° = 5.6713, and cotangent^{2}10° = 32.163

$$\frac{\text{cotangent}^2 10^\circ + 1}{\text{cotangent}^2 10^\circ - 1} = \frac{32.163 + 1}{32.163 - 1} = 1.064$$

$$\sqrt{1.064} = 1.0315$$

$$\text{secant}^{-1}\ 1.0315 = 14^\circ 13'$$

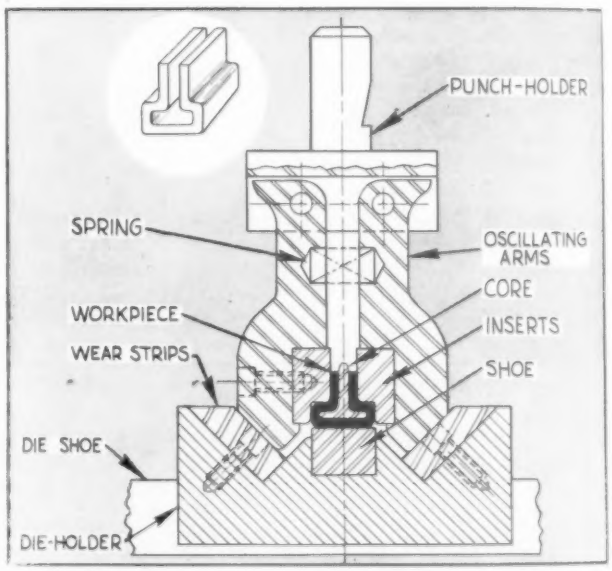
$$b = 10^\circ + 14^\circ 13' = 24^\circ 13'$$

R. G. Winter,
Carnegie Institute of Technology

Oscillating Forming Die

WHEN FORMING PARTS such as shown at upper left in the illustration, it is usual practice to make a die with laterally moving cams actuated by inclined planes. However, this type of construction is fairly expensive and, as a rule, requires presses with comparatively long strokes.

The method schematically shown offers a practical yet inexpensive solution for design problems of this nature. The tool consists of a die having two Vees symmetrically disposed on either side of the centerline and provided with hardened and ground wear strips and a hardened shoe.



The part which has been pre-formed is closed in by the oscillating jaws closing against the retractable core.

The punch is composed of two oscillating arms, hinged in a slotted punch holder and provided with hardened inserts. The arms are held open by means of a spring and spread is arrested by ears at the upper ends.

Attached to the die shoe, but provided with a slight float and a tapered lead-on, is a hardened core that conforms to the inside shape of the workpiece. In operation, the workpiece—which has been pre-formed—is slipped over this core. As the ram descends, the oscillating arms are closed in by the Vees until arrested by the workpiece and enclosed core. This method has many applications.

Frederico Strasser
Santiago de Chile

GOOD READING

A Guide to Significant Books and Pamphlets of Interest to Tool Engineers

DESIGN OF MACHINE ELEMENTS, by **M. F. Spotts**, Assoc. Professor of Machine Design at The Technological Institute, Northwestern University, is a well-prepared work on the basic problems of machine design and related to the design and incorporation of the various elements which compose the machine.

Realizing that design of machine elements must recognize certain principles related to the strength of materials, the author has reviewed these fundamentals. Emphasis has been placed on stress concentration and repeated loading, and a thorough discussion of the theory of torsion is included.

Among the machine elements covered, are the various types of springs, screws, belts, brakes, clutches, ball and roller bearings, gears, flywheels, roller chains, gaskets, and others.

Factors to be considered in the incorporation of welded or riveted connections in the machine design, form the subject of one chapter. Problems involved in lubrication, as affecting machine design and particularly the efficiency of journal bearings, are covered by another chapter.

The chapter on dimensioning and details is concerned with the fundamentals of fits and tolerances, including a discussion of surface roughness and the "preferred numbers" system of determining a range of sizes for a product or part. A brief review of the metallurgical influences on machine design is presented under the heading of Engineering Materials.

The author has designed each chapter as an entirely independent unit, so as to widen the book's usefulness as a text and reference work. Thus, it makes little difference in what order the various chapters are read.

Throughout, typical engineering problems are presented and immediately followed by the solution. Innumerable formulae are included with the text, the information thereby becoming immediately applicable.

The 402-page illustrated "Design of Machine Elements" is available at $6.65 per copy from *Prentice-Hall, Inc.*, 70 Fifth Ave., New York 11.

QUALITY CONTROL, by **Norbert L. Enrick**, is another book designed to simplify statistical quality control. In this case, the author has succeeded in presenting, free from any complicated mathematical formulae or scientific garble, an interpretation of quality control procedures adequate for their application in the average manufacturing plant.

The book provides a step-by-step course of action for installing a modern quality control system, based upon scientific principles, without need of calling in a mathematical "expert."

Two chapters are included for supplementary reading if desired. These, in every man's English, explain the statistical basis of modern quality control and the mathematical theory of control charts.

For many plants, this 122-page simplified manual of "Quality Control" should be of real assistance. It can be ordered, at $3.00 per copy, from *The Industrial Press*, 148 Lafayette St., New York 13.

MOLYBDENUM: STEELS, IRONS, ALLOYS, by **R. S. Archer, J. Z. Briggs**, and **C. M. Loeb, Jr.**, is a thorough exposition of the alloying applications of molybdenum. Throughout this book, the fields of similarity and dissimilarity of the various materials are pointed out, with mention of the factors to be considered in the choice of the most economical and practical material for a specific part.

The introductory chapter covers the basic technical effects of adding molybdenum to steel, cast steel, and cast iron. The following chapter offers information on the fundamental effects of heat treatment on microstructure. Another section is devoted to the various processes employed in adding molybdenum to steel and other metals.

The properties, characteristics, methods of heat treating, and industrial applications of the various metals in which molybdenum is a constituent are given in detail. These materials include wrought alloy engineering steels, wrought corrosion resistant steels, wrought steels for elevated temperature service, a wide range of tool steels, steel castings, cast iron, and many special purpose and nonferrous alloys.

The 391-page book incorporates 188 figures and 91 tables. Many of these are unusually lengthy and complete, such as Table 74 on the typical applications of gray cast irons containing molybdenum. This table, occupying 20 pages, includes comparative physical properties of many compositions.

The appendices include data on standard compositions of American, British and French engineering steels, working stresses from the Boiler Code, coversion tables, and a concise listing of the physical properties of metallic molybdenum. The publishers, *Climax Molybdenum Company*, 500 Fifth Ave., New York 18, plan to distribute the book, free of charge, to all metallurgists and others closely concerned with the subject of this book.

DIMENSIONAL ANALYSIS OF ENGINEERING DESIGNS, Vol. 1 Components (Part 1), as prepared by the **United Kingdom Inter-Services Committee** for Dimensioning and Toleranc-ing of Drawings, is a comprehensive manual, establishing for armament work a basic system for tolerancing tools, gages, jigs and fixtures of various degrees of precision.

The purpose was primarily to have available, in the event of any future warfare, the principles by which engineers anywhere in the world could be guided in tooling for the production of interchangeable parts of products supplied to the armed services of the United Kingdom. While the examples given are typical ordnance problems, the principles presented are applicable to any peacetime production of interchangeable parts.

Among the basic principles discussed are the requirements of interchangeability, use of standards, hole or shaft basis, unilateral and bilateral tolerances, the functioning, manufacturing, and inspection datums, omission of redundant limits, effect of gage tolerances and wear, and magnitude of tolerances.

Among the chapter subjects are Cylinders, Gaps and Widths; Lengths; Angles and Tapers; Squares, Hexagons, and D-Sections; normal geometrical requirements; detailed analysis of special functioning requirements; Profiles and Radii; and Screw Threads.

Appendices include definitions of engineering terminology; tabulated tolerances for common machining processes; recommended principles for inspection gages; and effect of errors in inspection gages.

This book—published by His Majesty's Stationery Office—is worthy of study by any engineer involved in the design of, tooling for, or control of quality of interchangeable parts. The 123-page manual (paper bound, 8½ x 11 in.), amply illustrated, is available at $2.35 postpaid from *British Information Services*, 30 Rockefeller Plaza, New York 20.

TRADE ASSOCIATION INDUSTRIAL RESEARCH describes the methods by which technical and scientific research is conducted on an industry-wide basis. It describes how research is financed, technical committees and projects selected, programs coordinated and supervised, and the results disseminated.

The 63-page booklet is available, at 25c per copy, from the *U. S. Department of Commerce*, 1038 Federal Bldg., Detroit 26.

THE TOOL ENGINEER'S *Service Bureau*

FREE BOOKLETS AND CATALOGS CURRENTLY OFFERED BY MANUFACTURERS

Acetylene Torch, Pistol Grip

Booklet describes lightweight Century Gas Gun, an automatic acetylene torch with pistol grip, for instantaneous application of the flame in soldering, silver soldering, light brazing, paint burning, preheating, and other uses. *Century Aircraft Co.*, 5607 W. Century Blvd., Los Angeles 45.

Automatic Machines

General catalog covers line of Multi-Slides, high speed automatics for production of precision stampings from coil stock; Multi-Millers, cam-controlled automatic millers for intricate operations on small parts; and such automatic press room equipment as slide feeds, stock straighteners, and coil cradles. *U. S. Tool Co., Inc.*, Ampere (East Orange), N. J.

Bronze Alloys and Products

A 16-page condensed catalog, Bull. 95, gives essential tabulated information on Ampco aluminum bronze alloy and other copper base alloys, mill products, non-sparking safety tools, resistance and arc welding electrodes, corrosion-resistant centrifugal pumps, plug valves, and fabricated assemblies. *Ampco Metal, Inc.*, Milwaukee 4, Wisc.

Carbides, Cemented

Kennametal catalog, No. 48, (68 pages) covers complete, diversified line of cemented carbide tools. Among items included are 5 styles of tools having indexable and replaceable solid vertical inserts; 4 styles of tools having indexable and replaceable flat tips; 5 styles of tools for heavy and medium heavy duty planing of cast iron; roll-turning tools; and standard wear-resistant parts. *Kennametal, Inc.*, Latrobe, Pa.

Cleaning, Metal

Catalog gives composition, characteristics, and applications of the detergents, inhibitors, caustic cleaners, and other scientifically-prepared compounds for a wide range of specific cleaning, brightening, protective and other purposes. *Cee-Bee Chemical Co., Inc.*, 6623 Stanford Ave., Los Angeles 1.

Clutches, Industrial

A 12-page catalog, No. SDOC, provides full description and engineering details of the complete line of Rockford friction clutches of the over-center toggle type. These compact, small-diameter clutches come in capacities from .5 to 1.7 HP per 100 RPM. *Morse Chain Co.*, 7601 Central Ave., Detroit 8.

Die Casting Machine

Bulletin gives detailed information on universal high-pressure hydraulic die casting machine, available with quick-change hot chamber end for zinc, tin or lead, and cold chamber end for aluminum, magnesium or brass. *The Cleveland Automatic Machine Co.*, Cincinnati 12, O.

Drill Jig Bushings

A catalog of the complete line of drill jig bushings, made to A.S.A. standard, covers headless press fit, head press fit, slip renewable, and fixed renewable types, also headless liners. Included is a copyrighted "Time Saver Table" for determining the number of parts which can be made from a given amount of material. *West Coast Aero Tool Co.*, 5401 Fountain Ave., Los Angeles 27.

Drill Jigs, Standardized

A 16-page catalog, covering the Esco line of standardized drill jigs, features the interchangeability of adapter and busing plates, and the single-lever quick clamping positive locking action. Jigs permit economical tooling, especially for short runs of small parts where custom tooling would be impractical. *Acme-Danneman Co., Inc.*, 203 Lafayette St., New York 12.

Fixture Parts and Fittings

Bulletin catalogs the wide variety of standardized fixture parts and fittings including knobs, clamps, cams, rest buttons, coupling nuts, keys, T-bolts, swing bolts, and others. *West Point Mfg. Co.*, 19625 Merriman Ct., Farmington, Mich.

Gages, Sapphire

Circular No. 5 covers the line of standard sapphire plug and ring gages and micrometers, and describes the Tipt-Type sapphire plug gage (approx. 1/4" sapphire tip metallically bonded to hardened steel leaders). *Sapphire Products Div'n.*, Elgin Nat'l. Watch Co., Aurora, Ill.

Gear Shaving

"Red Ring Shaving Produces Better Gears" —a 20-page booklet—covers the latest developments in gear practice as related to this firm's rotary shaving process. *National Broach and Machine Co.*, 5600 St. Jean, Detroit 13.

Jig Borer, Precision

Type 2A3 Swiss jig drilling and boring machine—for the machining of most delicate work and medium sized work, with a capacity of drilling holes from 1/64" up to 7/16" and of borings up to 7/8" dia.—is fully described and illustrated in 8-page bulletin. *Hauser Machine Tool Corp.*, Manhasset, N. Y.

Machines

Comprehensive catalog, No. M-1646, presents the complete line of modern machinery—milling and die sinking, broaching, cutter sharpening, cutter and tool grinding, precision grinding, and centerless grinding machines; the Flamatic, an electronically controlled flame hardening machine; and Cimcool, a multi-purpose cutting fluid—a chemical emulsion. *The Cincinnati Milling and Grinding Machines, Inc.*, Cincinnati 9, O.

Mills, Carbide Micro

Bulletin 16-W features carbide micro-mills, both straight shank and taper mount series. Also included is a listing of carbide midget mills. *Severance Tool Industries, Inc.*, Saginaw, Mich.

Presses, Punch

A 12-page catalog, covering the line of open-back inclinable punch presses, gives detailed specifications of various models and engineering data on SR-4 gage analysis as applied to these presses. Included are instructions for calculating a job's press tonnage requirements. *Diamond Machine Tool Co.*, 3429 E. Olympic Blvd., Los Angeles 23.

Punch-Die Units, Multi-Notch

Catalog N (16 pages) illustrates the many standard punch and die units for multi-notching of mild steel up to 1/8" thickness—sheets and angles—on stamping presses and press brakes. *Wales-Strippit Corp'n.*, N. Tonawanda, N. Y.

Spindles, Motorized

Catalog No. 58—in 64 pages of recommendations, specifications, and mounting data—provides complete information for positive selection of the correct heavy duty, motorized, precision spindle and wheel holder or cutter head. Spindles feature sealed-in lubrication and range from 3/4 to 20 HP and from 900 to 3600 RPM. *Pope Machinery Corp'n.*, 261 River St., Haverhill, Mass.

Springs, Stock

Bulletin presents the "Hook-Kon" spring kits, the more complete set offering a spring cutter, 96 ft. of assorted extension springs, 16 ft. of assorted compression springs, and a Hook-Kon spring looping tool—"a squeeze of the hand and the loop is made!" Tools are available separately. *Gardner Wire Co.*, Dept. TE, 5045 W. Lake St., Chicago 44.

Steel, Stainless

"Allegheny Metal in Chemical Processing" is the latest in a series of brochures showing the application of stainless steels in various industries. This 36-page booklet draws a parallel between the growth of the stainless and the chemical industries, showing the influence of each on the other. *Allegheny Ludlum Steel Corp'n.*, Pittsburgh 22, Pa.

Steel Selector Chart, Tool

A 21" x 31" tool steel selector and identification wall chart—which carries a 12-color reproduction of the Matched Set Diagram— will soon be available to enable users to quickly identify any of the Carpenter tool and die steels, now being painted in distinctive colors, and to quickly select the proper steel required for any application. *The Carpenter Steel Co.*, 354 W. Bern St., Reading, Pa.

Straightening Press

Bulletin PS-48 covers the expanded line of hydraulic presses for straightening rough or finished work. Included is the recently-announced PS-75-12, a press with 75-ton capacity and 12-inch stroke, sufficient for the largest work commonly requiring straightening. *Colonial Broach Co.*, Box 37, Harper Sta., Detroit 13.

Templates, Drafting

A 4-page catalog illustrates 15 specialized time-saving templates for engineers, designers, and others. Included are laminated templates for electrical symbols, pipe and plumbing views, welding symbols, and plain and side elevations of standard cap screws. *Rapi-design, Inc.*, P. O. Box 592, Glendale, Cal.

Valve, Gas Cock Safety

Bulletin SDL 2R-5 describes many features of the MR-2-5 safety valve for all fuel gases. Valve provides automatic 100% safety shut-off, and manual safety reset with line closed, using but one handle. *General Controls*, 801 Allen Ave., Glendale 1, Calif.

Welding Repair

"Jim's Eutectips" takes its bow as a bi-monthly house organ offering helpful bits of wisdom on the improvement of an operator's welding, particularly in the repair field. First issue is devoted to automotive repairs. *Eutectic Welding Alloys Corp'n.*, 40 Worth St., New York 13.

North East West South
IN INDUSTRY

Donald P. **Hess**, Pres. of American Brush Corp'n, is newly-elected Director and Chr. of the Executive Committee of **Hungerford Plastics Corp'n**, Murray Hill, N. J.

Arthur L. **Chapman** has added management of the Jamestown, N. Y., plant of **Sylvania Electric** to his responsibilities as Plant Mgr. at the Warren, Pa., plant.

Dr. **John A. Hutcheson**, after four years as assoc. director, has been appointed Director of the **Westinghouse Research Laboratories**, succeeding Dr. L. Warrington Chubb, who has retired, being named Director Emeritus.

Dr. **Haldon A. Leedy**, acting director since the resignation of Dr. Jesse E. Hobson, has been named Director of **Armour Research Foundation of Illinois Inst. of Technology**. **Edgar A. Jett II**, previously in charge of sponsor relations, has been appointed Ass't Director.

At the recent Semi-Annual Meeting of **The American Society of Mechanical Engineers**, **James M. Todd**, New Orleans consulting engineer, was nominated as the next President. Formal election is by mail ballot of the membership.

Harold K. Work, Mgr. of Research and Development of the Jones and Laughlin Steel Corp'n, has been nominated for the Presidency of the **American Society for Metals**, to convene at Philadelphia, Oct. 25.

Dr. **Robert D. Huntoon**, Ass't Ch'f of the Atomic Physics Div'n, **Nat'l Bureau of Standards**, has been awarded a medal for distinguished achievement by the **Washington Academy of Sciences**. He was cited for his research in "the advancement of electronics and its application to other sciences." **Dr. A. V. Astin**, Ass't Ch'f of the Electronics Div'n, has been awarded His Majesty's Medal **(United Kingdom)** for Service in the Cause of Freedom, in recognition of services rendered to the Allied War effort.

Wilfred Sykes, President of Inland Steel Co., will receive the 1948 award of Merit from the **Chicago Technical Societies Council**, at its October meeting.

W. **Lane Witt**, a former editor of INDUSTRIAL MARKETING, has resigned as President of National Industrial Advertisers Ass'n, to become Pres. of **Sales-Aids**, a cooperative market research organization for industrial marketers, with offices at 410 S. Michigan Ave., Chicago 5.

Siewek Tool Co., Detroit, has appointed **F. H. Robertson Tool Co., Inc.**, Malden, Mass., as distributor for New England, and **Acme-Danneman Co.**, New York City, for Eastern New York and New Jersey. These firms will carry a complete stock of Siewek rapid clamping jigs, fixture locks, and fixture details.

M. J. Herbs, a member of the **E. W. Bliss Company** staff for the past eleven years, has been appointed Ass't Export Mgr., with offices at the Bliss New York address, 19 E. 47th St.

Neville Blond, a member of the **British Embassy** staff, has been appointed United Kingdom Trade Adviser in the United States, with offices at 6214 Empire State Bldg., New York, in addition to his offices at the Embassy in the nation's capitol.

A. Price Drummond

Niles - Bement - Pond Co., West Hartford, Conn., has appointed, as **Pratt & Whitney** machine tool engineering head, **A. Price Drummond**, since 1924 machine development engineer with National Carbon Co. He relieves **Paul Mueller**, who will devote full time to engineering research for Pratt & Whitney, Chandler-Evans, and Potter & Johnston.

Firth Sterling Steel & Carbide Corp'n, McKeesport, Pa., has appointed **A. B. Vestal** to the management staff. A Carnegie Tech graduate, Mr. Vestal has been with the Carnegie Illinois Steel Corp'n for the past eight years.

Recent appointments in the Wire and Cable Dept. of **United States Rubber Co.** include **Howard H. Weber**, Chief Eng'r, and **A. S. Basil**, Gen'l Sales Mgr.

George J. Schad, ass't treas. and comptroller, has been elected Treas. and a Director of **Tinnerman Products, Inc.**, Cleveland mfrs. of Speed Nuts. **William H. Taylor** has been appointed Director of Eng'g.

Fred C. Foy, vice-pres. of J. Walter Thompson, national advertising agency, has joined the Central Staff of **Koppers Company, Inc.**, as Vice-Pres. and Mgr. of Sales. In the Shops Div'n, **Edward R. Hall**, a Vice-Pres., will assume the duties of Ass't Gen'l Mgr., with **Arthur C. Thompson** succeeding him as Works Mgr.; Major Gen'l **Cecil R. Moore** has been named Mgr. of the Construction Dept.

John W. LeDuc, recently head of his own consulting engineering firm, has been appointed Vice-Pres. of the **Castaloy Corp'n**, Detroit 17.

Sales promotion and advertising mgr. for the past two years, **M. A. Boyle** has been appointed Sales Mgr. of the Solder Div'n, **Alpha Metals, Inc.**, Brooklyn, N. Y.

Appointments made recently by **Electro Metallurgical Co.**, New York, include **Russell Franks**, Chief Metallurgist, with headquarters at Pittsburgh. The following Division Service Managers were named: **J. N. Ludwig, Jr.**, Pittsburgh; **R. J. Portman**, Chicago; and **F. W. Hanson**, Detroit.

Neil F. Ritchey, lately in charge of non-ferrous metallurgy at the Fort Wayne, Ind., plant of General Electric, has been named a technical service engineer at **Reynolds Metals Co.**, Louisville, Ky.

At **Willys-Overland Motors**, Toledo, O., **Robert E. Busey** has been promoted to Ch'f Eng'r, succeeding **Walter D. Appel**, appointed Director of Procurement. **Cecil L. Johnson**, formerly Works Mgr., will be in charge of special projects on the staff of the director of manufacturing facilities and methods.

R. P. Wolchina, who has held similar positions in various well-known mass production industries, is now Factory Mgr. of **Conlon Bros. Mfg. Co.**, Chicago Mfrs. of White Way washing machines.

H. N. Arbuthnot, Ass't to the Pres., **Allegheny Ludlum Steel Corp'n**, has been transferred from Detroit to Washington, D. C., where he will represent the company and its president in relationships with governmental agencies, and will also be Manager of Sales in that area.

James M. White, formerly vice-pres. in charge of mfg. at the Allis-Chalmers Milwaukee plant, has joined the production management staff of **Allen-Bradley Co.**, mfrs. of electric controls, Milwaukee, Wis.

With offices and plant at 708 Hawthorne St., Glendale 4, Calif., the recently-organized **Superweld Corp'n** will offer a modern and efficient brazing and metal treating service, and will manufacture its own line of specialized products. Furnaces and brazing equipment of Warner Welded Products have been acquired. Principals of the new firm are **Walter T. Wells**, **Robert E. Jones**, **C. B. Lansdown**, and other West Coast industrialists.

COMING EVENTS

Sept. 13-17. AMERICAN INSTRUMENT FAIR and Conference, sponsored by Instrument Society of America. Convention Hall, Philadelphia.

Oct. 25. 30th NATIONAL METAL CONGRESS and EXPOSITION, sponsored by American Society for Metals. Convention Hall, Philadelphia.

TOOLS OF TODAY

"Holesteel" Drills by Natco

National Automatic Tool Co., Richmond, Ind., offers three Model C, Type B "Holesteel" multi-spindle machines designed to handle a wide variety of drilling and tapping.

These machines are equipped with electrically controlled hydraulic feed systems providing infinite feed range, and pick-off gears to provide a wide selection of spindle speeds. Each model can be supplied with either of two bases, similar except for working area.

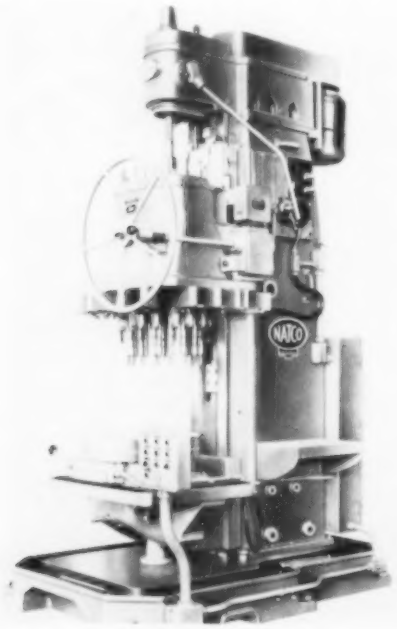
The small area base is supplied for adjustable table applications or for stationary fixtures mounted on the base, while the larger base is suitable for rotating and sliding type fixtures. Models C2B and C3B machines can be supplied with adjustable knee type work table, with the entire assembly having a vertical adjustment of approximately 12" through a crank operated elevating screw.

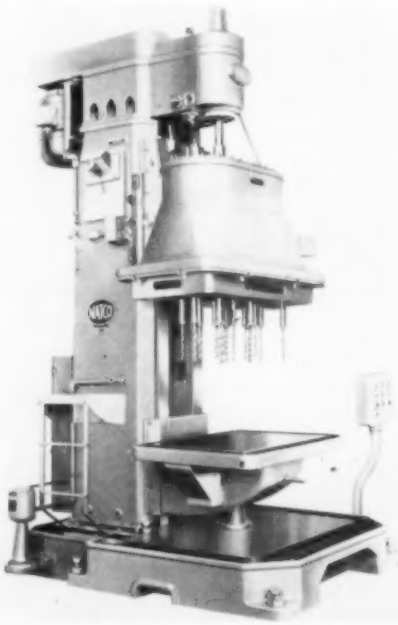
Design, for each model, incorporates a heavy box section column, to prevent deflection under heavy thrust loads. Slideways are of close grained, high tensile cast iron, but may be had of hardened and ground steel. Hydraulic pressure pumps and piping are contained in the upper section, bolted to the column, while the lower section encloses the head counterbalancing weight.

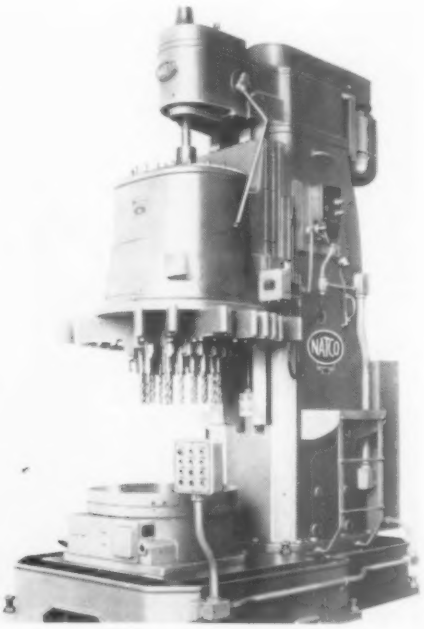
Adjustable spindle heads are of anti-friction mounted construction, each spindle having independent speed change gear to provide high, low and neutral changes, the latter providing idle spindle. The head is lubricated by a cascade system. The spindles may be located in any position within the area of the head and a drive angle of 35° or less, and may be vertically adjusted 2" to compensate for tool wear or differences in length. Facing and depth setting is effected by a fine adjusting screw.

A tapping attachment, consisting of a manual head feed arrangement working in conjunction with an electrical recessing control, can be added. The head, which carries a travel limit dog operating a limit switch for cycle control, is traversed by a handwheel, and floating tap holders allow different lead taps to be used in any one set-up.

Additional attachments can be furnished, such as a step drilling attachment to allow drilling of deep holes by increments of depth with completely automatic cycle, and a remote push button control, for setup, which provides rapid advance, coarse and fine feed, and rapid reverse for all phases of the cycle. Coolant, delivered as required by a motor driven pump, returns to the reservoir via wide channels in the table and base. T-8-1



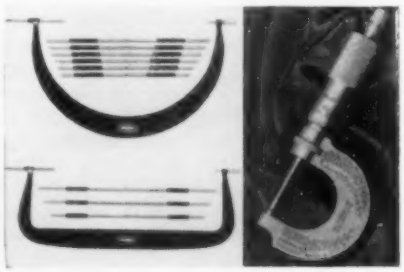




Tubular Mikes by Starrett

L. S. Starrett Company, Athol, Mass., announces a line of Tubular Micrometers designed to provide large capacity for precision measuring with the lightness and rigidity required for accurate positioning, sensitive feel and minimum fatigue. The steel frames are hollow-formed in two sections and joined by welding to produce a flat tubular shape at once rigid and light.

The instruments are available in bow and bar types, the one for measuring in thousandths over a 6" range in eight capacity ranges from 12-18 inches up to 54-60 inches. The bar type is available on special order with sliding or interchangeable anvils in sizes from 12" range up to 168" in steps of 6 inches. Either bow or bar type can be furnished with dial indicator heads and special measuring contacts for direct reading.



Further announced by the company, all Starrett micrometers, including black frame, will now be furnished with "Satin Chrome" finish on the thimble and sleeve as a standard feature. This finish is said to obviate glare and to permit graduations to stand out sharp and clear under any illumination. Smaller micrometers will also have this finish on the frames, as shown by the 1-inch mike.

Other improvements include Hi-Micro or mirror finish on faces of spindles and anvils to insure more accurate measurement; screws hardened and ground from the solid; and quick reading fixtures. T-8-2

Measuring Tools by B & S

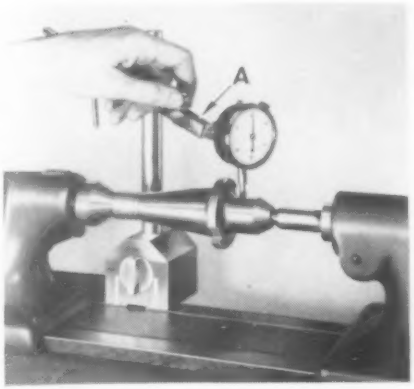
Additions to the line of measuring instruments manufactured by Brown & Sharpe Mfg. Co., Providence 1, R. I., include Dial Holding Rods with fine adjustment, designated as "A" in photo and shown mounted on a magnetic base. Available in two sizes.

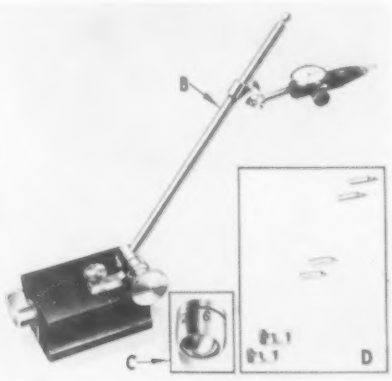
Also, Dial Test Indicator No. 743 with fine adjustment and magnetic indicated by "B" in photo. Practically any type of dial indicator can be mounted on the spindle, and the magnetic base provides stability when using.

Also, Base Attachment No. 226, which snaps on either the anvil or spindle end of a micrometer caliper and permits direct measuring of wall thickness of tubing or similar work, shown at "C" in photo, and Center and Small Hole Attachment No. 573, shown at "D" in photo.

With the latter attachment mounted on a vernier caliper, holes to be drilled may be accurately located; also, distance between two holes or between a hole and a locating point may be accurately determined. Available in two sizes, 0.025" and 0.050" radius, and as 60° points, one side flat for scribing.

T-8-3



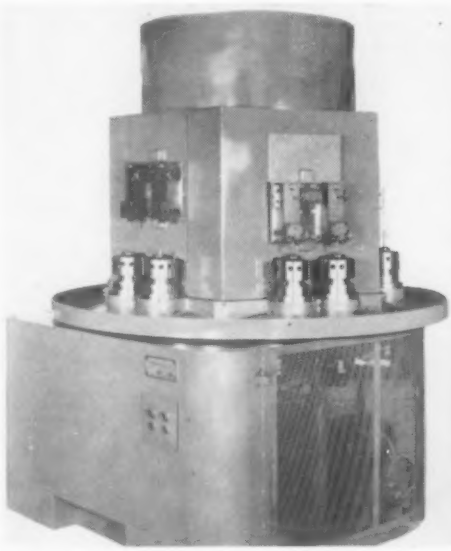


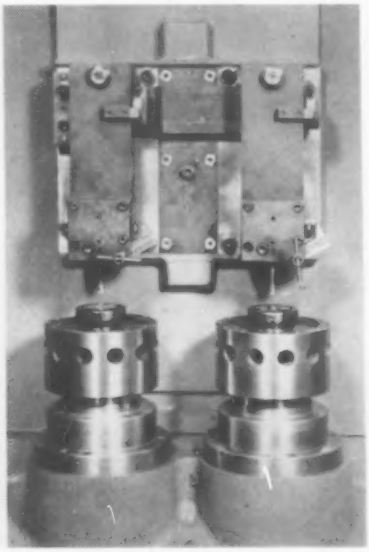
Machine for Carbide Tools

Announced by Hoern and Dilts, Inc., 925 Rust Ave., Saginaw, Mich., is a 5-station, 10-spindle machine especially designed for use with the solid cemented carbide boring tools recently developed by Carboloy Company, Inc. The machine is pentagonal, each side carrying two precision boring heads each of which, in turn, takes a carbide boring tool.

In operation, the heads and work table revolve continuously. The work spindles stop turning at the loading station, where the boring bars also retract. The spindles start again, automatically, when the loading station has been passed. Capacity of work is 6" maximum O.D. and ¼" minimum I.D., and maximum boring depth on the standard machine is 5".

Accuracy of the machine is indicated by the boring of valve guide bushings in which the length to diameter ratio is 7:1. These guides (said to be produced at the rate of 800 per hour) are bored half way on the first pass, then reversed to complete the bore. Yet, alignments and concentricity are claimed to be within .0002". On parts having a 6:1 length to diameter ratio, production is said to reach 1400 pieces per hour accurately bored. T-8-4





Mount for Portable Tools

A Mounting Fixture for portable tools --Model 7101, by Aro Equipment Corp'n, Bryan, Ohio—is suited to screw driving, nut setting, grinding, polishing and other operations where it is more practical to bring the work to the tool and where production can be stepped up as a result of worker having use of both hands.

The fixture will accommodate Aro air tools from smaller sizes up to the ½" drill, and is said to be also suited to the general run of air and electric tools. T-8-5

Die Hobbing Press

The addition of a Die Hobbing press to its line of hydraulic presses, announced by the E. W. Bliss Company, 450 Amsterdam Avenue, Detroit 2, is rated at 500 tons pressure at a pressing speed of 2" per minute.

The press, designed for manufacturers needing a number of reproductions of certain dies for use in multiple stamping operations, produces these reproductions by forcing a master punch into metal blocks. The resulting cavities thus conform to contours of the master punch.

The frame of this press, which is self-contained, consists essentially of two steel castings rigidly mounted on four heavy steel tie rods. Safety shields are provided for all openings to the die space, and control is accomplished by means of manually operated valves fitted with handwheels and located conveniently on the front of the press.

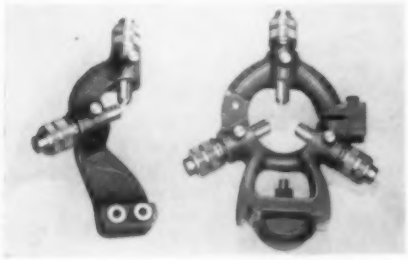
T-8-6

DeLuxe Work Supports

Deluxe type Follower Rests and Center Rests, recently announced by South Bend Lathe Works, 417 East Madison St., South Bend 22, Ind., are designed to provide quicker and more efficient operation on certain classes of lathe work.

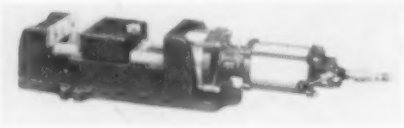
These attachments feature wrenchless adjustment and locking of the jaws, effected by a large knurled knob and a thumb screw.

A double acting compound screw thread provides approximately $\frac{3}{16}$" jaw movement, for each turn of the knob, with smooth action and just enough resistance to hold the jaw securely in position until locked. The jaws, made of brass, slide through precision steel sleeves pressed into the supporting frame, and are easily replaced. Both follower and center rest are available for current models of South Bend lathes. **T-8-7**



Air-Hydraulic Vises

The Bellows Company, Akron, Ohio, announces the Bellows Model DVH-150 Air-Hydraulic Vise, which uses flexible, controlled air pressure to develop a clamping pressure of 150 times the operating air line pressure from any air line pressure up to a maximum of 125 lbs.

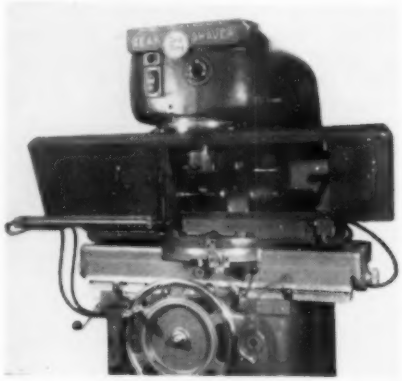


Opening of the jaws is adjustable from a fraction of an inch to a maximum of 5", in increments of $\frac{1}{32}$", through a positive locking adjusting nut on the hydraulic ram; yet, operation through the jaw power movement is only 2/10ths of an inch—said to be—ample for clamping most rough castings and to provide important safety protection. Power is obtained from a Model BM-10 Bellows air motor in combination with a special built-in hydraulic intensifier unit.

The vise is available with either mechanically-operated valve, for hand operation, or for mechanical syncronization to machine movement; or with the Bellows low-voltage solenoid valve for electrical operation. Overall length is $30\frac{7}{16}$", width 9", height $6\frac{1}{8}$". In addition to 6" x $1\frac{5}{8}$" hardened steel jaws, the vise is also equipped with soft steel false jaws. **T-8-8**

Improved Gear Shavers

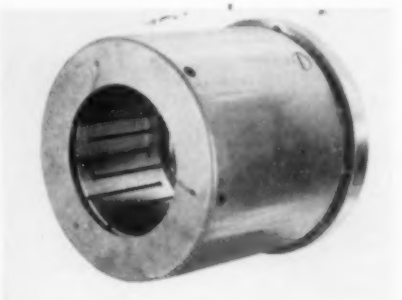
Two developments in connection with gear shaving, recently introduced by National Broach & Machine Company, 5600 St. Jean, Detroit 13, Mich., are said to materially reduce operator effort and, at the same time, to increase production.



One of these is the "Fast-Lock" tailstock, which reduces the operation of loading work to one motion; the same for unloading. By means of a screw advance and locking mechanism, the operator locks the work by pushing the handle away, and retracts the tailstock for unloading by pulling the handle toward him. The handle locks positively, as soon as the center is sealed, without need of jamming or extra pressure.

The second development is an air actuated, electrically controlled automatic splash guard, available in several designs to meet varying conditions. After loading the work, the operator presses a start button which automatically closes the door and starts coolant flow and cutting. When cutting ends, the coolant is shut off and the door opens automatically, exposing the finished part for unloading. **T-8-9**

Top Size Collet Chuck



Model 1200, added to the line of precision collet chucks by Erickson Tools Division, 2309 Hamilton Ave., Cleveland 14, Ohio, is designed to accommodate Erickson standard collets over a range of 8" to 10" in increments of 1/32".

Since the workpiece is firmly gripped throughout the length of the collet, wear is evenly distributed with resultant sustained accuracy. **T-8-10**

Deep Drawing Press

Two principles of force applicati[illegible]—mechanical and hydraulic—have [illegible]een combined in a line of presses for [illegible]he double action deep drawing of fer[illegible]us and non-ferrous metals by the Ve[illegible]on Allsteel Press Co., 1355 E. 93rd St., Chicago 19, Ill.

Known as Type MH Verson Double Action Presses, this line is said to have the high productive capacity of the mechanical drawing press plus the adjustable blankholder features previously found only in hydraulic presses.

Among advantages claimed for this mechanical-hydraulic press are: Increased production on deep draw; instantaneous adjustment of pressure by valves, and direct reading gauges at any pressure point on the blankholder; blankholder, self-adjusting for any thickness of stock, automatically compensates for minor variation in stock thickness during normal operation; all need for use of shims to obtain correct and uniform blankholding pressure is eliminated; and, no tool-damaging impact between blankholder, stock and die.

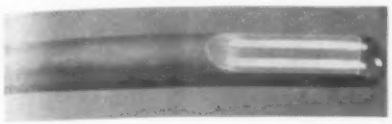
These presses can be readily converted from double action press work to single action press work. Press cycle, including the delayed action return of the bed cushions, is fully automatic and controlled by means of electric push button and selector panel.

This type of press is available in a wide range of bed sizes and tonnage capacities, all applicable to deep drawn sections by the double action method, or wherever both double action and single action equipment is required. **T-8-11**

For Tool Engineers Service Bureau See Page 80

Triple-Core Solder

Acid core solders, announced by the Solder Div'n of Alpha Metals, Inc., 363 Hudson Ave., Brooklyn 1, N. Y., and named Alpha Tri-Core "Leakpruf," has been developed to solder stainless steel, monel, nickel and other metals which, heretofore, have not been readily solderable with core solders.



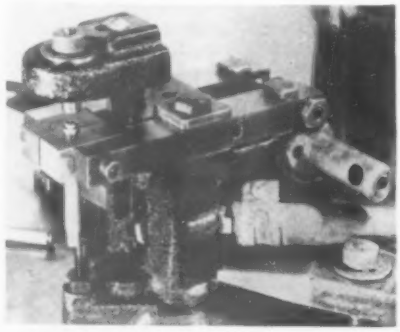
Synthetic acid, replacing the usual zinc chloride, is said to be readily soluble in water and to wash off easily; also, the triple core provides the proper volume of flux with a resultant superior bond. **T-8-12**

Portable Strapping Tools

The Strap Kit, by A. J. Gerrard & Co., 221 No. LaSalle St., Chicago 1, contains Steelbinder Strapping Tools, carries enough coiled strapping and seals to handle several jobs without a refill and provides a practical and economical means of carrying strapping equipment to out-of-way points of use. **T-8-13**

Versatile Fixture

A Universal Part Holder, by Mueller Industries, 4755 No. Rockwell St., Chicago 25, is designed for fast production on drilling or milling operations, and may be operated manually or automatically by mechanical means or attaching to an air line.



Self-centering the fixture takes work up to 1" round or hex, with drill capacity up to ½". Standard A.S.A. drill bushings are used, with height of bushing adjustable for chip clearance and coolant entry. **T-8-14**

WENDT SONIS

Line of Reamers IS COMPLETE

CARBIDE FULL LENGTH FLUTE REAMERS STRAIGHT OR TAPER SHANK

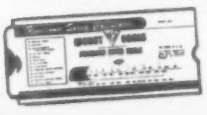
LEFT HAND SPIRAL REAMERS
RIGHT HAND SPIRAL REAMERS
CARBIDE TIPPED REAMERS STRAIGHT OR TAPER SHANK
JOBBER REAMERS STRAIGHT OR TAPER SHANK
STUB SCREW MACHINE REAMERS
SHELL REAMERS

- COMPLETE RANGE OF SIZES
- WIDE SELECTION OF STYLES
- HARDENED STEEL SHANKS
- ADVANCED DESIGNS

The W-S line of reamers is so complete that they can meet practically all your reaming requirements. For example, W-S Straight Shank Reamers style SSR are available from stock in 37 sizes ranging from ⅛" to 1½". Similar ranges of sizes are available in 12 other types of standard reamers. Quick delivery can be obtained on standard reamers with special diameters and tolerances. "Engineered for the Job" design increases production and saves on tool costs. You get longer wear—greater accuracy when you select Wendt-Sonis Reamers for your requirements.

Free! W-S SPEED AND FEED CALCULATOR

Quickly figures feed and speeds on reaming and other operations. Write WENDT-SONIS COMPANY, Hannibal, Missouri; 580 North Prairie Ave.; Hawthorne, Calif.; 1361 West Lake St., Chicago, Ill.; Warehousing Facilities—Eastern Carbide Corp., 909 Main St., New Rochelle, N. Y.



WENDT SONIS

CARBIDE TIPPED CUTTING TOOLS

BORING TOOLS • CENTERS • COUNTERBORES • SPOTFACERS • CUT-OFF TOOLS • DRILLS • END MILLS • FLY CUTTERS • TOOL BITS • MILLING CUTTERS • REAMERS • ROLLER TURNING TOOLS • SPECIAL BITS

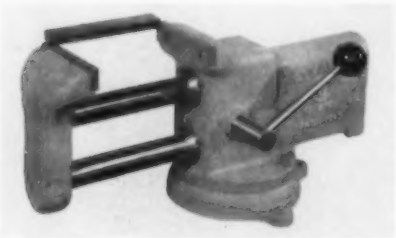
Carbide Center Reamers

Carbide Center Reamers, developed by Severance Tool Industries, Inc., Saginaw, Mich., for the finishing of centers after heat treating, are said to produce the same burnished-like finish obtained when hardened materials are turned or milled with carbide tools.

Suited for materials up to 63-C Rockwell hardness, these center reamers have cutting teeth especially developed to eliminate chatter and to correct misalignment, as by shifting centers. They have standard 60° included angle, are available in ⅜" and ½" diameters, and may be used with drill presses, centering machines, or standard center lapping machines. **T-8-15**

Quick-Acting Bench Vise

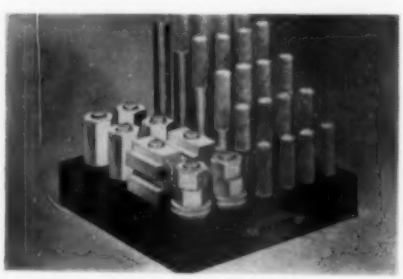
With the Model 450 Bench Vise, by the Hartmann Mfg. Co., 1600 Junction Ave., Racine, Wis., the jaws are easily pushed against the work and then locked by straight lever action, solidly clamping the work. No time loss, as with the conventional screw.

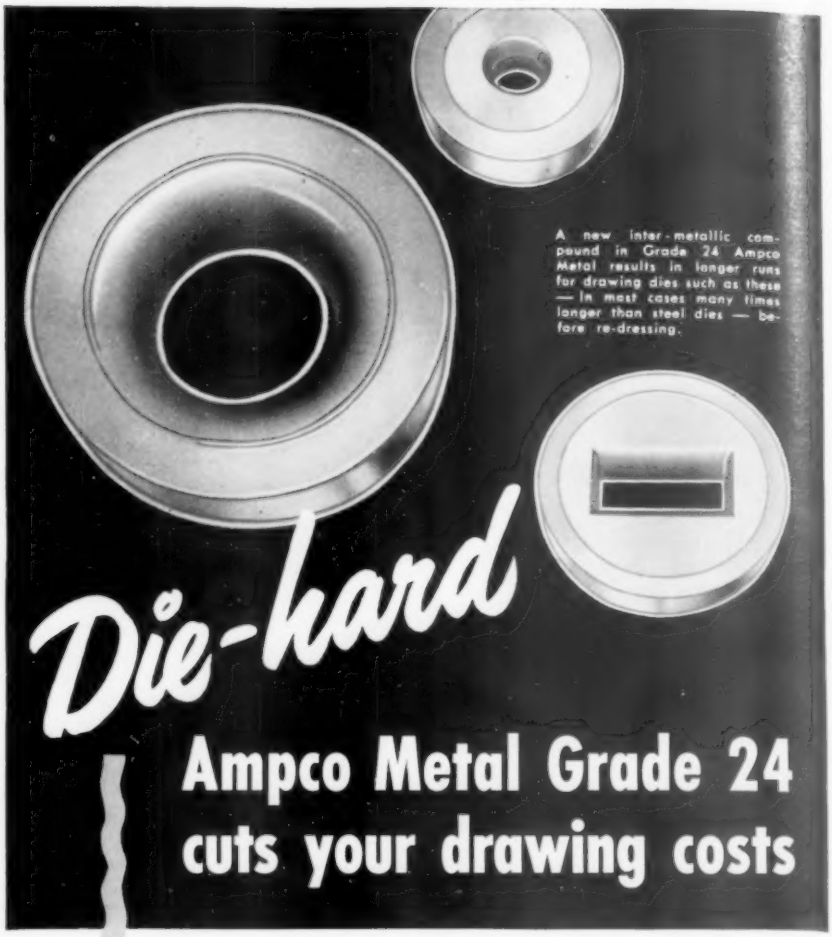


Jaws are 4½" wide, maximum opening 6", and a full 360° swivel base is locked with a nut instead of a lever so as to obviate injury to quick moving hands. Finished in green crackle. **T-8-16**

Improved Stud and Nut Set

Conveniently arranged stud and nut sets, introduced by West Point Mfg. Co., 19659 Merriman Ct., Farmington, Mich., are available in ½", ¾", and ⅝" standard thread sizes, class 3 fit. Each set includes four each of 3", 4", 5", 6", 7", and 8" studs, and four each of the nuts, washers, T-slot nuts and coupling nuts, the latter providing stud lengths from 3" to 16". Specially designed and machined T-slot nuts permit the use of studs to the full capacity of the T-slot. **T-8-17**




A new inter-metallic compound in Grade 24 Ampco Metal results in longer runs for drawing dies such as these — in most cases many times longer than steel dies — before re-dressing.
Die-hard
Ampco Metal Grade 24
cuts your drawing costs

Gives longer runs before re-dressing — no galling and loading on stainless steel

Here's the new Ampco Metal Alloy — Grade 24. It gives you more hardness and compressive strength than any other bronze — even more than Grade 22 Ampco Metal which you have used for your drawing and forming work in the past. Machinability of Grade 24 is about the same as that of Grade 22.

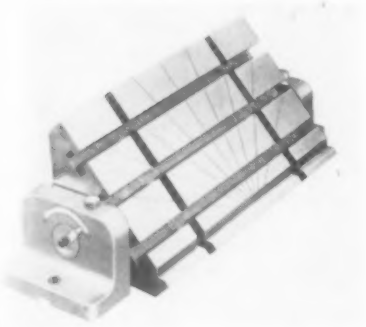
Dozens of disinterested shops have already tested this new alloy in die work. They *proved* that Grade 24 gives you 2 to 5 times the die life previously considered standard.

These tests also proved that Grade 24 Ampco Metal dies are superior to steel dies on many jobs, especially stainless steel. A typical test case showed a 77,000 run on an Ampco Metal die, compared to a 3000 run on a steel die. The Ampco Metal die does not seize or gall. There is less frequent need for redressing. As a result, you get longer runs at lower cost. Actual superiority varies according to die-tolerances and working stock.

Plan now to get more work per dollar from your dies. Use the longer-run advantages of Grade 24 Ampco Metal to avoid investment in more expensive carbide dies. See your nearby Ampco engineer today, for the complete cost-cutting story on Grade 24! Write for bulletins giving complete data today.

Ampco Metal, Inc.
Dept. TE-8, Milwaukee 4, Wisconsin
Field Offices in Principal Cities

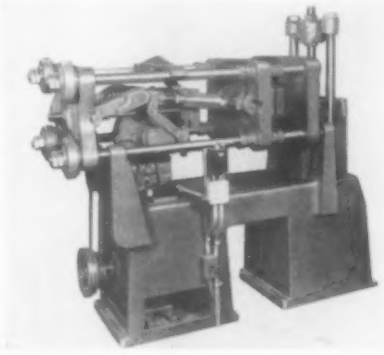
Tilting Work Table



Designed to make the milling machine more flexible, the Malnar Universal Work Table fastens quickly and securely on any milling machine. The table, which is 16 7/8" long by 9 1/8" wide, enables the operator to tilt the work from 0° to 45° in either direction and to lock it at the desired angle. A calibrated dial, at the end of the table, makes it easy to change the position of the work and to return it to previous position or to select any new position without removing the work from the table. **T-8-18**

Larger "Workhorse" Model

A larger, hydraulic model of the Workhorse fully automatic Die Casting Machine, announced by Light Metal Machinery, Inc., 736 Penton Bldg., Cleveland 13, Ohio, is designated No. 32 HZ and is designed for zinc, tin or lead production. Shot capacity is 32 ounces—twice that of the smaller air operated Model 16 AZ.

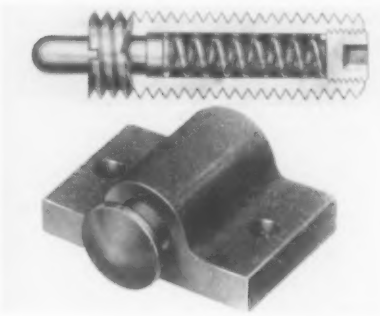


Claimed for the machine is a top speed of 720 shots per hour; other speeds 520, 340, and 240. Casting cycle is completely automatic, and die movement, shot and ejection follow smoothly in continuously repetitive cycles. Once the operator sets the machine's speed, the human element no longer determines hourly output. Between cycle delays are eliminated, and the operator merely fills the melting pot occasionally and lubricates the die.

Other advantages claimed by the manufacturer include faster die changes, greater dimensional accuracy, smaller floor space needs, and lower maintenance cost. **T-8-19**

Spring Plungers and Stops

A line of Spring Plungers and Stops, by Vlier Mfg. Co., Los Angeles, Cal., is designed to provide accurate spring tension action for holding and positioning work on dies and fixtures as well as for a wide variety of other applications.



The plungers, available in standard sizes with known spring pressure of 5 to 42 lbs., are threaded for mounting in fixture walls or bases, with insertion facilitated by a slot in the plunger end.

The Spring Stops serve practically the same purposes but are designed for bolting to fixture bases. The nose is slightly rounded, and the plunger has a 3/16" stroke with end pressures of 15 lbs. Both items are rust-proof finished and packed six to a box. **T-8-20**

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Specify WESPO parts and save in designing—no need to detail numerous parts which are now available from WESPO.
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F. E. ANDERSON OIL COMPANY
412 BROWNSTONE AVE.
PORTLAND, CONNECTICUT

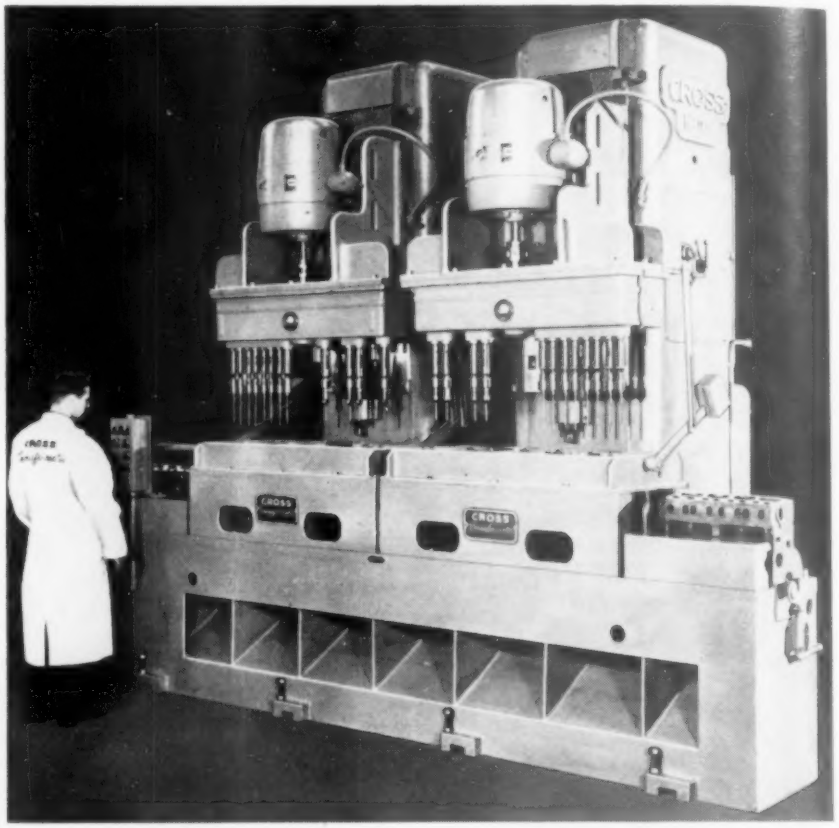
Special Machine by Cross

A special machine tool which combines four finishing operations on automotive cylinder blocks has been developed by The Cross Company, 3250 Bellevue, Detroit 7, Mich.

A Transfer-matic equipped with a continuous automatic material handling device, the machine was designed to permit maximum production with a minimum of physical and mental effort on the part of the operator, and is said to produce a total of 64 pieces per hour.

Four cylinder blocks are machined at one time, progressively. At station 1, eight valve guide bushings are rough reamed; at station 2, four exhaust valve insert parts are counterbored; at station 3, four intake valve seats are formed; and at station 4, the eight valve guide bushings are finish-reamed.

Mechanical features include a single lever cycle control, hardened and ground steel ways, hydraulic feed, rapid traverse, and simplified maintenance through the extensive use of duplicate standard Cross units. Conveyor connections are provided for bringing parts up to the machine and for taking finished pieces away. Transfer, locating, and clamping are all handled by automatic power. T-8-21



Self Sealing Test Plugs

A line of self sealing "Hydro-Matic" Test Plugs, announced by Mechanical Products Corp'n, 168 N. Ogden Ave., Chicago 7, Ill., is designed to seal plain or threaded holes in flanged or fitted openings in fabricated or cast vessels which require hydrostatic or air testing.

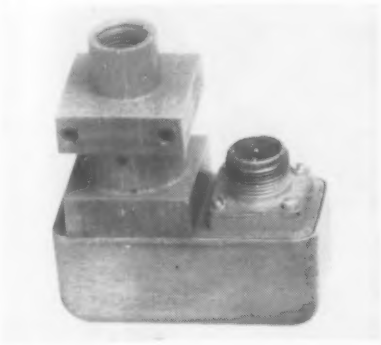
Claimed as a unique feature is the manner in which testing pressure from within the vessel is utilized to actuate a plunger with sufficient force to hold an effective seal regardless of the actual testing pressure used.

A safety feature, as well as a positive holding action, is controlled by the bayonet lock in the cylinder. This prevents use until the expanding heads are properly anchored to the inside edge of the fitting and the plunger is free to be actuated by the internal testing pressure to force and hold the neoprene seal firmly against its seat.

Stock sizes for ¼" to 2" pipe openings are available for standard flanges and are said to be suitable for any pressure up to 500 psi. T-8-22

Pressure Switches

A line of Pressure Switches—No. 9045—by Saval Company, 1915 E. 51st St., Los Angeles, Cal.—features adaptability to different fluids, air or gas. Designed to make or break an electrical switch in accordance with pre-set pressure, it can be made to operate throughout the full range of 100-5000 psi.



Indicated applications are automatic operation of sequence valves, fluid pumps and motors, and hydraulic systems in general. **T-8-23**

Small Hydraulic Press

A compact, hand-operated portable Hydraulic Press for laboratory or production work, has been introduced by Studebaker Machine Company, 1221 South 9th Ave., Maywood, Ill. Optional with the unit are electrically heated platens for plastics or other operations that require temperatures. Heating element is thermostatically controlled for even distribution of heat over entire platen.

Operation of hand lever produces up to 8 tons pressure between platens, and the press can be efficiently adapted to broaching, assembling, piercing, oil grooving, riveting, sizing, forming, flanging, staking, forcing, and small die tryouts. Special dies can be developed for any type of product requiring press work.

The unit is self-contained, and self-powered. There are no outside requirements. Control is entirely by hand lever; release by handy valve. **T-8-24**

Plier Models by Knu-Vise

Two recent Knu-Vise plier models, developed by Lapeer Mfg. Co., Lapeer, Mich., offer greater throat capacity and higher applied pressure.

Without any alteration in the total length of the pliers, the late design has been made to assume a square throat opening which permits thicker work to be inserted between the jaws to a greater depth, thus giving the pliers an increased range of applications.

The increased spindle diameter of $\frac{3}{8}$" gives greater stiffness and a more secure grip, particularly in lifting or pulling applications. For use in welding operations, the pliers can be furnished with copper spindles which do not allow adhesion of weld spatter.

Model P-1200, with throat capacity of $1\frac{5}{32}$" x $2\frac{1}{4}$", provides 1200 lbs. clamping pressure; Model P-1800, with throat capacity of $1\frac{5}{32}$" X $1\frac{1}{4}$", provides 1800 lbs. clamping pressure. These Knu-Vise pliers have the toggle-action locking krip which can be instantly applied and released. **T-8-25**

Fast Production Gage

A universal production gage—the Check-All, by Roper & Broderick, Inc., 1694 Main St., Springfield, Vt.—is designed to handle a wide variety of work.

In effect it is a simple comparator gage which, by changing the plate and pin and setting by masters, can be used to check many dimensions on the same part or on different parts. The gage pin is guided by a standard hardened steel drill bushing, replaceable for wear. The gage has a multiplication of 200 to 1, approximately, with a range of plus or minus .010". **T-8-26**

Production Recorder

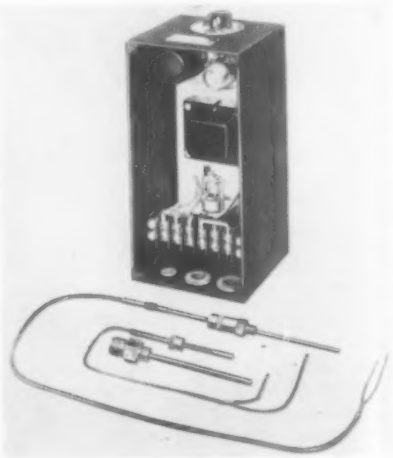
A speed and production Recorder by the Electric Tachometer Corp'n, 22nd & Vine Sts., Philadelphia, Pa., is electrically operated and produces a permanent record of speed and production when properly installed on production equipment.

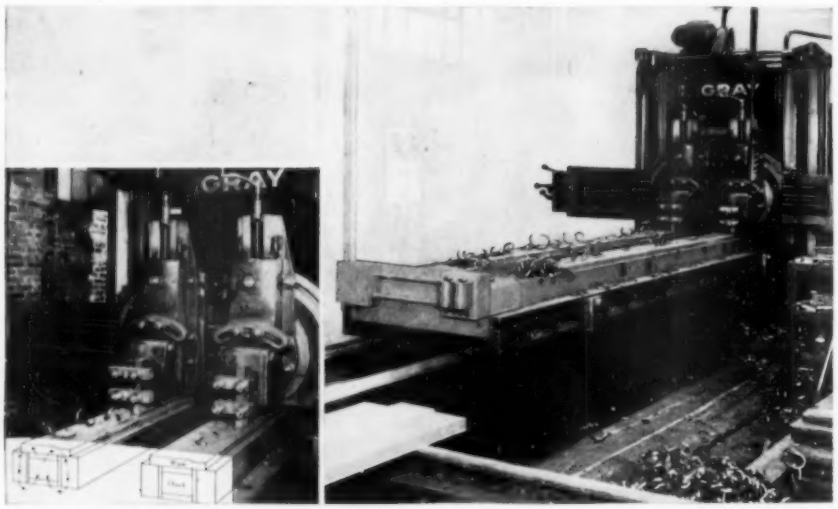
Called Model R-300-H, the recorder consists essentially of a synchronizing contactor which may be attached to and driven by the machine or its prime mover. In operation, the instrument shows irregularity of speed, idle time and provides comparison between production runs. **T-8-27**

Temperature Controller

An electronic Temperature Controller, developed by the Instrument Div'n of Thomas A. Edison, Inc., West Orange, N. J., uses a single electronic tube with an electrical resistance type bulb for thermal pick-up. Normal response time is said to be less than three seconds.

The resistance bulb permits location of the sensing element at a point remote from the conrol panel and is said to eliminate the necessity of thermal compensation. The device is non-indicating and may be used to control temperatures to close tolerances. **T-8-28**





Power-Grip Holding Provides Rare Possibilities For Lowering Planing Costs

The work illustrated above is planing shear blades, 18-feet long, two at a time, held with Power-Grip Chucks. On jobs of this type, requiring two mechanical settings, changing to Power-Grip Magnetic Holding accomplishes a reduction in floor-to-floor time representing an extremely favorable cost adjustment. And added to the time-saving factor is improvement of the quality of work resulting from the uniformity with which the entire length of the material is held down.

Power-Grip Chucks represent a modern magnetic holding technique offering broad possibilities of production improvement that can be effected immediately.

You can quickly learn the possibilities for any job by sending us prints and operating data, so we can submit a complete proposal for Power-Grip Holding.

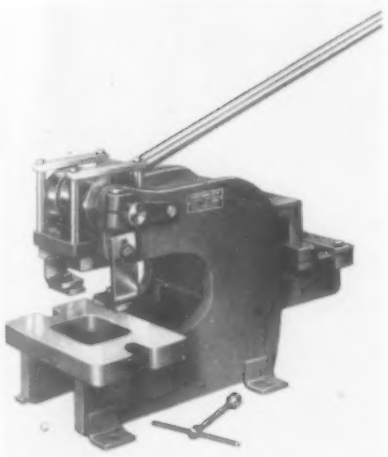
ROCKFORD MAGNETIC PRODUCTS CO., INC.
1304 18th Avenue, Rockford, Illinois

Send for This Booklet

ROCKFORD POWER-GRIP CHUCKS

Hand Punch Press

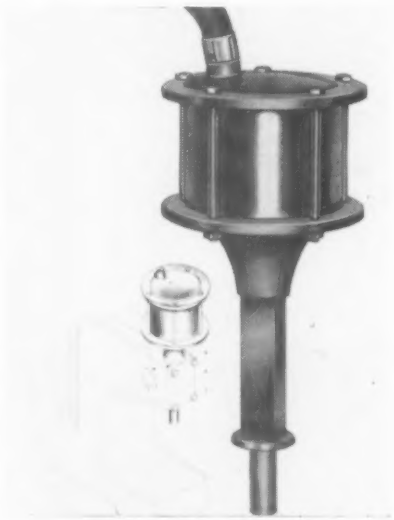
The Leslie Welding Company, 2943 Carrol Ave., Chicago 12, Ill., announces a Hand Punch Press—Model A—which has no ram, ways or slides, yet is said to have the accuracy of a leader pin die set.



Press capacity is 3″ diameter through 16 ga. mild steel, or 2″ diameter through 12 ga. mild steel; however, power can be increased by applying a pipe extension to the press handle.

Alignment, maintained by a leaf assembly is claimed to be so accurate that shearing of dies is reduced to a minimum and that notching can be done without providing heels to the punches. **T-8-29**

Air Conversion Unit



An Air Conversion Unit, by Paragon Metal Products, 844 W. Adams, Chicago 7, is designed to convert conventional bench arbor presses into power operated tools for speeding up staking, piercing, assembly, and successive operation jobs.

The unit replaces the manually operated ram and exerts a pressure about 12½ times over line air pressure.

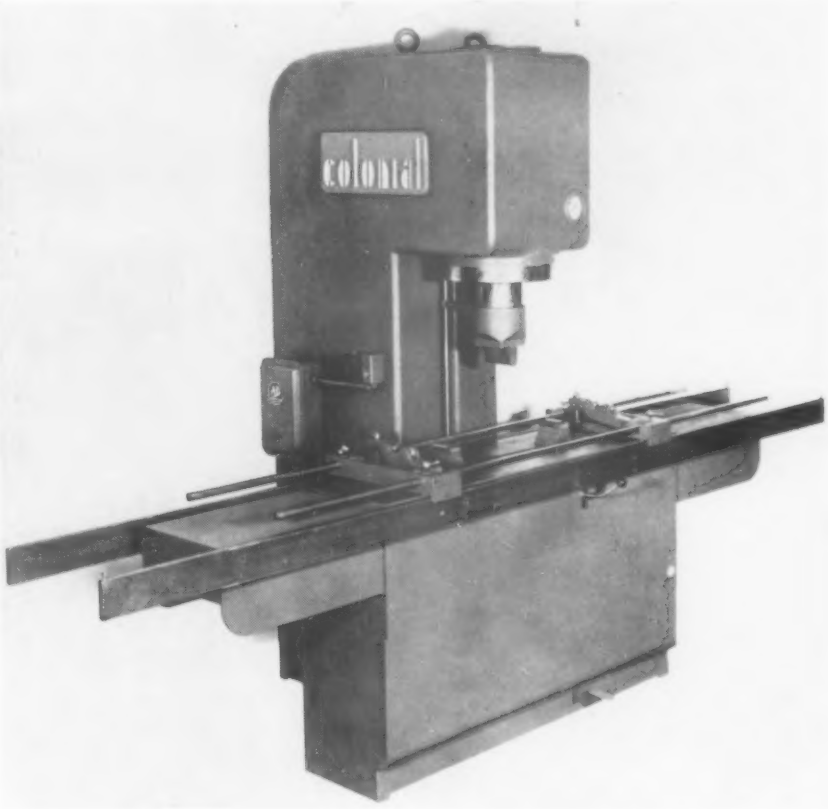
T-8-30

Large Straightening Press

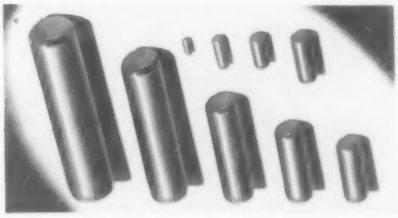
A larger 75-ton model—PS-75-12—added to its line of 15, 20, 35, and 50-ton hydraulic straightening presses by Colonial Broach Company, Box 37, Harper Station, Detroit, Mich., is designed for handling both finished and rough work and employs a double rail straightening fixture to take care of larger and heavier work.

Reinforced welded steel construction is used for the open side frame design, and motors are built-in. Rams are direct acting from high capacity hydraulic cylinders mounted in the head and, if desired, are available with bronze ram noses in place of the standard steel design. The same is true of work support anvils, which may be either center or roller type depending on the nature of the work to be handled. Guide rails are extra long to prevent sagging of long work beyond the work anvils.

Floor space is 54 by 140 inches, including the straightening fixture. Stroke of the ram is 12 inches, with a power stroke speed of 45 inches per minute and a return speed of twice this amount. The hydraulic system is operated through a 15 HP, 1800 rpm motor. Standard equipment includes hand controls and pressure gage. Foot pedal operation is also available as special equipment. **T-8-31**



Holo-Krome Dowel Pins

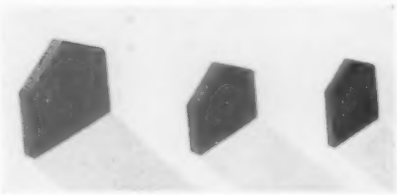


Holo-Krome Screw Corp'n, Hartford, Ct., announces a line of Holo-Krome Dowel Pins with rust resistant black lustre finish which, in addition to retarding corrosion and rusting, also acts as a lubricant.

The pins are hardened and precision ground and are furnished, in all standard sizes, in sealed boxes clearly labeled to show quantity and sizes.

T-8-32

Masonry Drill Tips

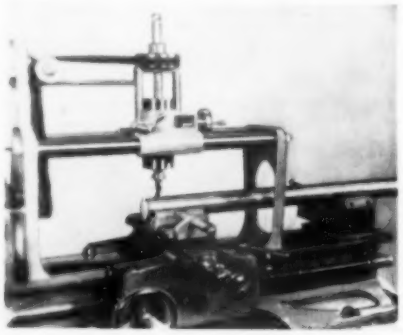


To meet increasing demand for carbide tipped masonry drills,the Adamas Carbide Corporation, 1819 Broadway, New York 23, N. Y., announces a line of carbide masonry Drill Tips, manufactured in the full range of popular sizes and designed for original insertion or replacement in steel shanks. These tips may be used with percussion type as well as rotary masonry drills.

T-8-33

Vertical Milling Attachment

Palmer Industries, Inc., 6149 South Sangamon St., Chicago 21, Ill., announced a vertical milling attachment which can be applied to all makes of bench lathes by removing the compound and installing a vise, furnished as standard equipment, in its place. The milling attachment is then set on the ways, to which it is clamped firmly from underneath. Adapters are provided for each make of lathe.



The unit is driven by the lathe spindle through "V" belt and adjustable pulleys, with the longitudinal feed and cross feed used the same as on a milling machine. The attachment will make a cut 8" long on the longitudinal feed and half of the distance of the cross feed, and will take stock up to 3" in diameter under the cutter. **T-8-34**

SUPER brings the carbide drill picture up to date!
Increasing use of carbide in production drilling with its proven economies has, for some time, demanded a revamping of drill standards. Super has tackled the problem.
Bring your records up to date! Write today for Super's new bulletin listing revised size ranges and prices on carbide tipped and solid carbide drills.
Standard Solid Carbide Twist Drills 1/16" to 1/4" Wire Sizes .1520 to .0595
Standard Straight and Taper Shank Carbide Tipped Twist Drills 1/8" to 1"
Now
All Super Twist Drills are shipped with complete instructions on recommended applications, speeds and feeds.
SUPER
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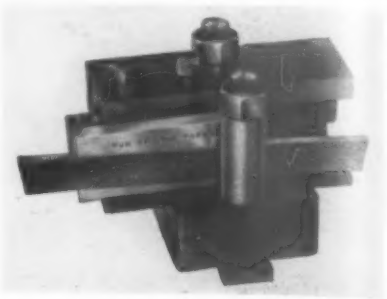
SUPER TOOL COMPANY
21650 Hoover Rd., Detroit 13, Michigan • 5210 San Fernando Rd., Glendale 3, California

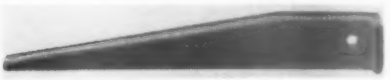
R & L Turning Tools

Included in a wide assortment of turning tools by R & L Tools, 1825 Bristol St., Philadelphia 40, Pa., is a tool post designed to hold several types of tools on the front or rear cross slide.



Other tools in the R & L line include cutting-off tools, knurling tools, die holders, box tools—in short, about every tool needed for turning operations on turret lathes and screw machines. **T-8-35**

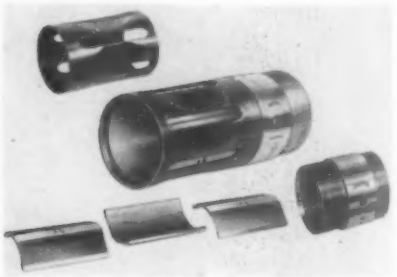
Drill Drifts Redesigned



The Cleveland Twist Drill Company announces Drill Drifts improved by adding a shoulder, or flange, on the head end. The drift is therefore less damaging to babbit hammers and a more direct, solid driving force can be applied to the enlarged end. Mushrooming is retarded because of the added metal at the head, and the enlarged end prevents the drift from flying through the spindle slot—thus, these drifts are safer and handier than the old style. **T-8-36**

Long Bearing Pusher

A Stock Pusher with extremely long bearing surface and called the "Sheffer Better Bearing Master Pusher," is announced by the Sheffer Collet Company, Traverse City, Mich.

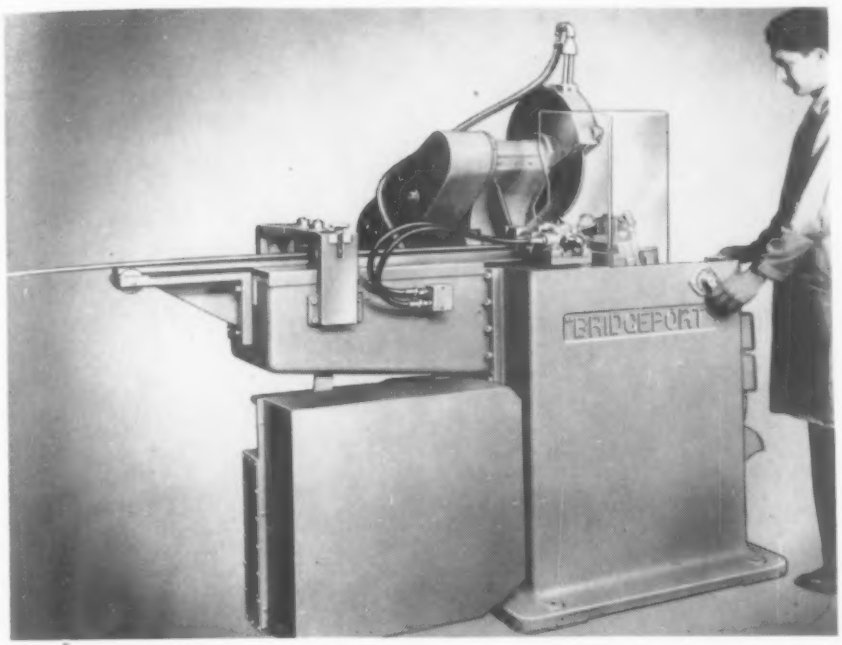


These pushers have external threads ground from the solid, to assure concentricity, and pads which may be quickly interchanged to suit various stock sizes and materials from rough bar stock to bars with highly finished surface. Tension is adjustable. **T-8-37**

Automatic Cut-Off Machine

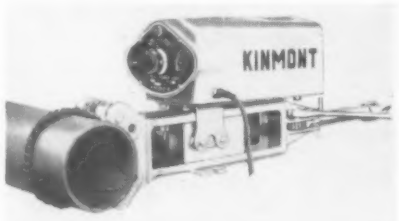
The Bridgeport Safety Emery Wheel Co., Stratford, Conn., announces a fully automatic abrasive Cut-off Machine designed for high speed cut-off of stock—steel, brass, plastics, porcelain—up to 2" square and to lengths ranging from ¼" to 12".

The head assembly, which consists of an 18" abrasive cut-off wheel driven through Vee belts by a 10 HP motor, is mounted on a rocker shaft running in Timken bearings and is actuated by a hydraulic cylinder which feeds the wheel in and out of the cut. The feed mechanism is synchronized with the cutting head and automatically feeds a predetermined length of stock into position where it is gripped by a holding vise. After the cut has been completed the wheel withdraws, the feeder returns to normal position, and the cycle is repeated automatically until the stock is exhausted or the machine is stopped by the operator. **T-8-38**



Universal Power Unit

Announced by Kinmont Mfg. Co., Inc., 718 W. Wilson Ave., Glendale 3, Cal., is a versatile Power Tool especially adaptable as a positioner for welding, cutting, threading, sandblasting and other work that can be facilitated by continuous turning.

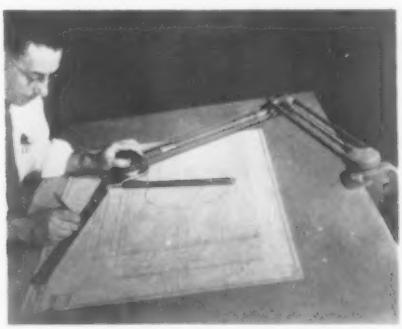


This power unit, which provides for the turning of round or hexagonal objects requiring up to 400 lbs. circumferential turning force at surface speeds from 3 to 26 inches per minute, operates on the chain tong principle and, weighing only 71 lbs., is therefore portable.

The unit can be mounted on a bench or stand and, by using adjustable roller fixtures, it is claimed to be applicable to objects weighing as much as 20,000 lbs. Work may be rotated in either direction. **T-8-39**

Improved Drafting Machines

Modern features, built into their "Equipoise" Drafting Machines by Charles Bruning Company, 4754 Montrose Ave., Chicago 41, Ill., are said to provide greater smoothness and accuracy with unhampered speed and alignment accurately maintained even though a board is tipped 20° from horizontal.



Other features include a revised protractor head assembly, providing greater convenience with maximum visibility. Furthermore, a redesigned base line setting locks the protractor index point to any angle, and distance between clamp screws has been increased to hold the machine more rigidly to the drawing board. **T-8-40**

Precision Jig Borer

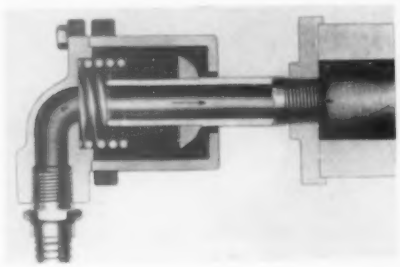
Announced by Hauser Machine Tool Corp'n, Manhasset, N. Y., is a Precision Jig Drilling and Boring Machine—Type 2A3—designed for delicate drilling and boring work by watch and instrument makers—as, for example, holes down to ⅛" diameter, and fine milling operations.

The machine will take medium sized workpieces or fixtures where drilled holes are up to 7/16" diameter and boring up to ⅞". However, a special boring tool holder provides boring up to 2".

A setting attachment, with dial indicator, serves for centering previously bored holes, aligning work true with a coordinate, or for accurately measuring distances between holes. In addition, a microscope on a 3-point suspension provides accuracy unaffected by any possible eccentric movement of the spindle. The graduated dials, and the verniers, are illuminated for easy readings. **T-8-41**

Rotary Pressure Joint

A self supporting Rotary Pressure Joint, developed by the Johnson Corp'n, Three Rivers, Mich., is designed to admit cooling or heating agents to rotating rolls in such applications where there is considerable lateral movement or where supports cannot be practically provided. **T-8-42**



Comparator for Heavy Work

A heavy-duty type of Dial Comparators—the No. 130—announced by the B. C. Ames Co., Waltham 54, Mass., is designed to provide a larger-size, precision Comparator of greater range and utility and to be especially useful for applications requiring the checking of comparatively heavy parts. The very rigid construction is also said to make it extremely accurate for general dimension checking on light-weight parts.

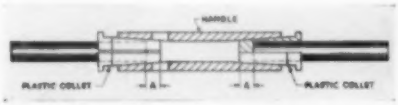
The base, of solid 1″-thick steel, has the top fine-fiinsh ground to a close-tolerance flatness, while a 3-button support eliminates rocking of the Comparator on the bench. The 1¼″ diameter upright post, of solid steel, is fixed to the base with permanent accuracy, and a heavy, positive upright post clamp has large diameter locking screws for easy tightening.

The 1″ diameter steel Indicator Bar has its own clamp, allowing indicator reach and adjustment to be made without changing the post clamp's vertical position. A special vertical adjustment, which attaches to the back of the indicator, provides for close setting of the indicator pointer on the dial.

The indicator usually furnished is Ames Model No. 202 with lift lever; dial graduated .001″, dial reading 0-100, and a .250″ indicator range. However, any size or range Ames Hundred Series Indicator can be supplied. The Base is available in any size, such as 10 x 10″, 10 x 14″, 16 x 16″, and up, and the size selected determines the weight of the comparator. The upright post can be furnished in any desired height. **T-8-43**

Collet-Held Plug Gages

Turner Brothers, Inc., 2625 Hilton Rd., Ferndale 20, Mich., announce collet held Plug Gages in which the gage members are held in opposite ends of the gage handle by means of self-locking plastic collets.



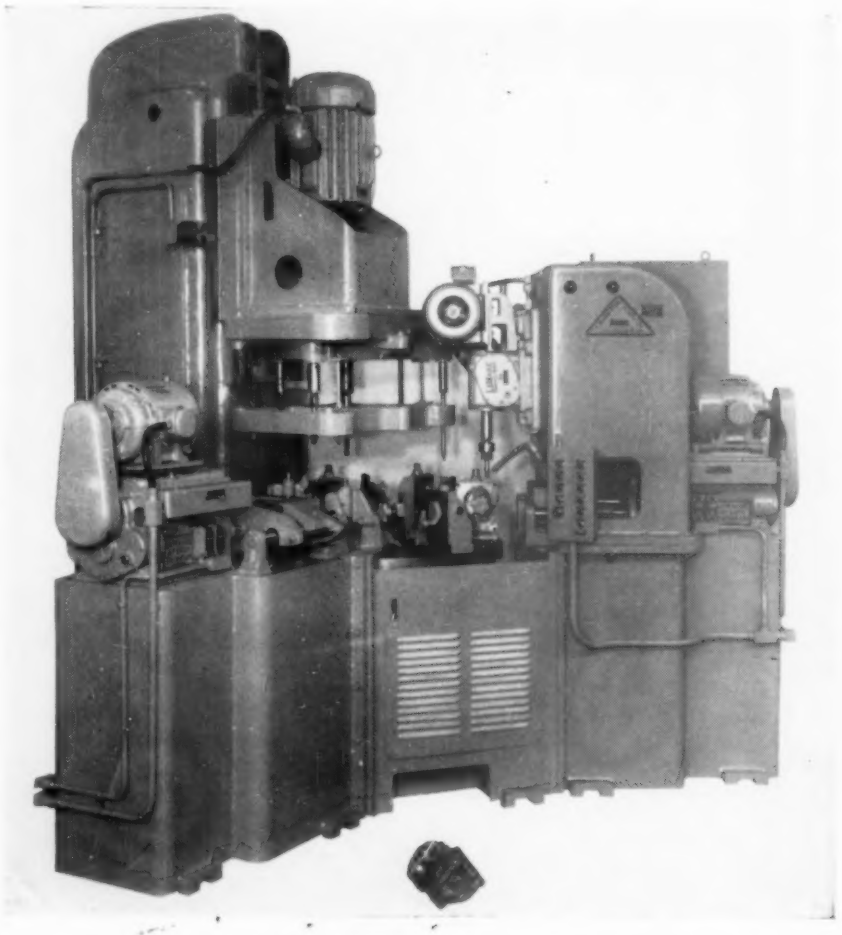
These collets are made with a solid base—"A"—which stops the gage member from slipping through when inserted into the handle. The collets, designed to provide a firm grip on the gage member, are black and red for "go" and "no go". **T-8-44**

Special Purpose Machine

Developed by LeMaire Tool & Mfg. Co., 2657 So. Telegraph Rd., Dearborn, Mich., is a special machine to drill, spotface, ream, countersink and tap seven holes in automotive transmission rear bearing retainers.

The machine, which has a stated output of about 138 pieces per hour, incorporates three different types of units, as follows: A vertical slide type drilling unit to provide wide, ample support for the 4-spindle head; two small horizontal twin ram quill type drilling units with single spindles; and a small vertical lead screw tapping unit with single spindle.

These units are mounted on a fabricated steel frame and are grouped around a 36″ diameter, 6-position automatic indexing table hydraulically actuated. The table carries six quick-acting fixtures and one part is completed at each cycle of the machine. **T-8-45**

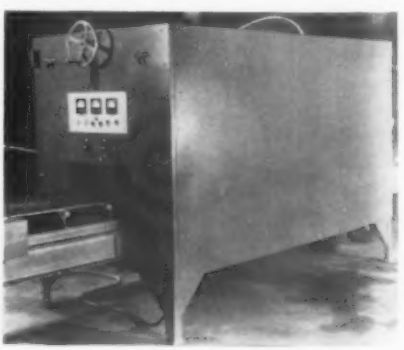


Core Baking Tunnel

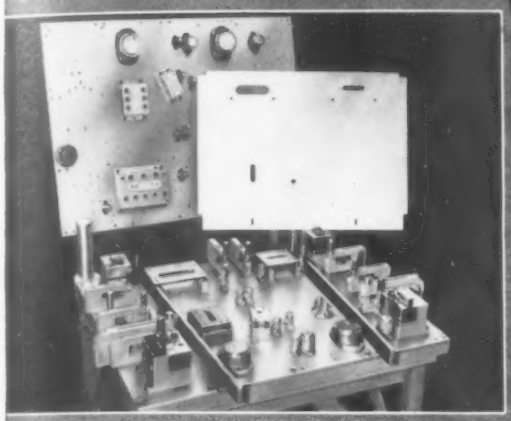
An electronic Core Baking Tunnel—Model M-800A Ther-Monic, by Induction Heating Corporation, 181 Wyeth Ave., Brooklyn 11, N. Y.—is said to have an average baking cycle of only a few minutes, a capacity of 650 pounds of core per hour and will further produce a ton of baked cores at a power cost of only 92 cents.

Advantages claimed are manifold, as, for example, baking time by electronic heating in from 20 seconds to a few minutes as compared to several hours in combustion ovens. The rapid baking cycle prevents core sagging during the baking operation; furthermore, green cores may be loaded directly onto a conveyor, in the core room, thus eliminating racking and a considerable part of the handling of cores in the green state **T-8-46**

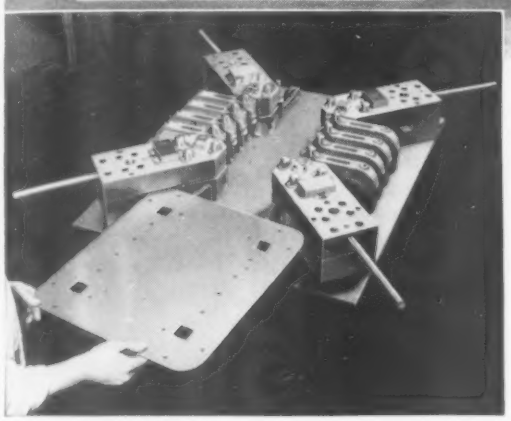
As further advantages claimed, there is no cooling period involved and the cores may go to inspection immediately on emerging from the tunnel. Also, it is claimed that, with resin binders, gassing has been reduced to a point where blow holes in the castings are no longer a problem.



A WORD ABOUT WALES SERVICE ENGINEERS WHO CALL ON YOU



Setup of Wales Equipment, made for a large stove manufacturer.



Wales Equipment set up for an air conditioning cabinet manufacturer. Note holes and rounded corners in the work in foreground.

A setup of Wales Type "CD" Hole Punching Units for a jet engine manufacturer.

● Wales-Strippit Service Engineers are specialists in hole punching and notching,—selling no other line of equipment. Many of these Service Engineers have had several years' experience in the Engineering and Production Departments at the Wales-Strippit plant. They know from experience what Wales Equipment will do for you. These Service Engineers are as valuable to you as the Wales Equipment. Illustrations of Setups at left are typical suggestions made by Wales Service Engineers. Call them in for suggestions.

AS A FURTHER SUGGESTION

Before deciding on the hole punching and notching portion of your tooling program, check with Wales-Strippit engineers who may solve your particular hole punching problems by using STANDARD adaptations of STANDARD Wales Equipment. Join the large group of leading manufacturers who have made it a rule to call on Wales-Strippit before putting holes in angles, channels, extrusions and sheets by *any* method.

WALES-STRIPPIT CORPORATION

GEORGE F. WALES, *President*

393 PAYNE AVENUE, NORTH TONAWANDA, N. Y.

(Between Buffalo and Niagara Falls)

WALES-STRIPPIT OF CANADA, LTD., HAMILTON, ONTARIO

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For your convenience, a key number follows the announcement of each product reveiwed in the *Tools of Today* section of THE TOOL ENGINEER. To obtain complete information on any of these products, circle the corresponding key numbers on this coupon, and mail the coupon to THE TOOL ENGINEER.

Gentlemen:

Please send me further information on the following Tools of Today items which I have checked:

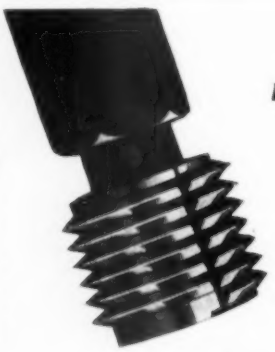
T-8-1 T-8-2 T-8-3 T-8-4 T-8-5 T-8-6 T-8-7 T-8-8 T-8-9 T-8-10 T-8-11
T-8-12 T-8-13 T-8-14 T-8-15 T-8-16 T-8-17 T-8-18 T-8-19 T-8-20 T-8-21 T-8-22
T-8-23 T-8-24 T-8-25 T-8-26 T-8-27 T-8-28 T-8-29 T-8-30 T-8-31 T-8-32 T-8-33
T-8-34 T-8-35 T-8-36 T-8-37 T-8-38 T-8-39 T-8-40 T-8-41 T-8-42

Name .....

Position .....

Firm .....

Street..... City, State.....



There IS a Difference In Gages !

Drunken Threads?

Republic's thread plugs are checked on a specially built instrument known as the drunken lead checker, which reads directly to .0001. "Drunkenness" in setting plugs makes proper adjusting of the rings almost impossible as a "jump" will be noted as the ring is set to the master.

Republic's gages with "THAT UNSEEN EXTRA QUALITY" cost no more.

RELY ON REPUBLIC

REPUBLIC GAGE

DETROIT 21, MICHIGAN

60 YEARS MANUFACTURING

Multiple Spindle Drilling and Tapping Machines —Automatic Drilling and Tapping Units— Multiple Spindle Attachable Drill Heads—Hot and Cold Swaging Machines—Hammering Machines—Tools, Jigs & Fixtures—Contract Work—Special Machinery.

Langelier Manufacturing Company
PROVIDENCE 7, RHODE ISLAND

LESS OPERATIONS AND BETTER WORK
WITH A GATCO ROTARY PILOT BUSHING
DUST PROOF

AS A WATCH

ROUND-CHATTERLESS-SMOOTH

GATCO Rotary jig and pilot bushing is built for core drilling, diamond boring, turret tool piloting, piloting hollow mills, line reaming, carbide boring, spot facing, etc.

Originators of Rotary Jig & Pilot Bushings
GATCO ROTARY BUSHING CO.
1300 Mt. Elliott Avenue • Detroit 7, Michigan

Broaching CRANKSHAFT CHEEKS

at the rate of

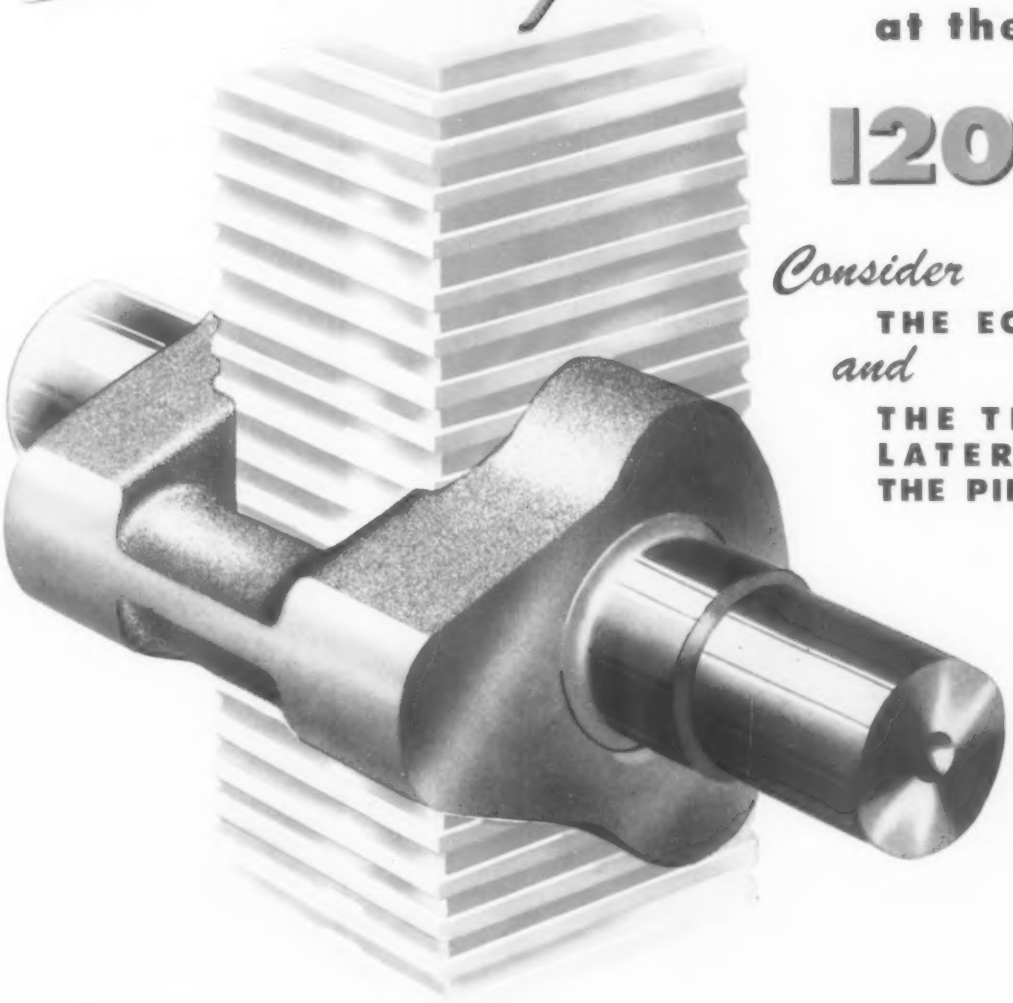
120 per hour

Consider

THE ECONOMY

and

THE TIME SAVED LATER TURNING THE PIN DIAMETERS



BROACHING the throw cheeks on crankshafts is an ideal broaching application. Tooling can be fairly simple and the production savings *really* worthwhile. Broaching removes the stock from the cheeks faster than any other method and thereby increases the production output when later turning the pin diameters.

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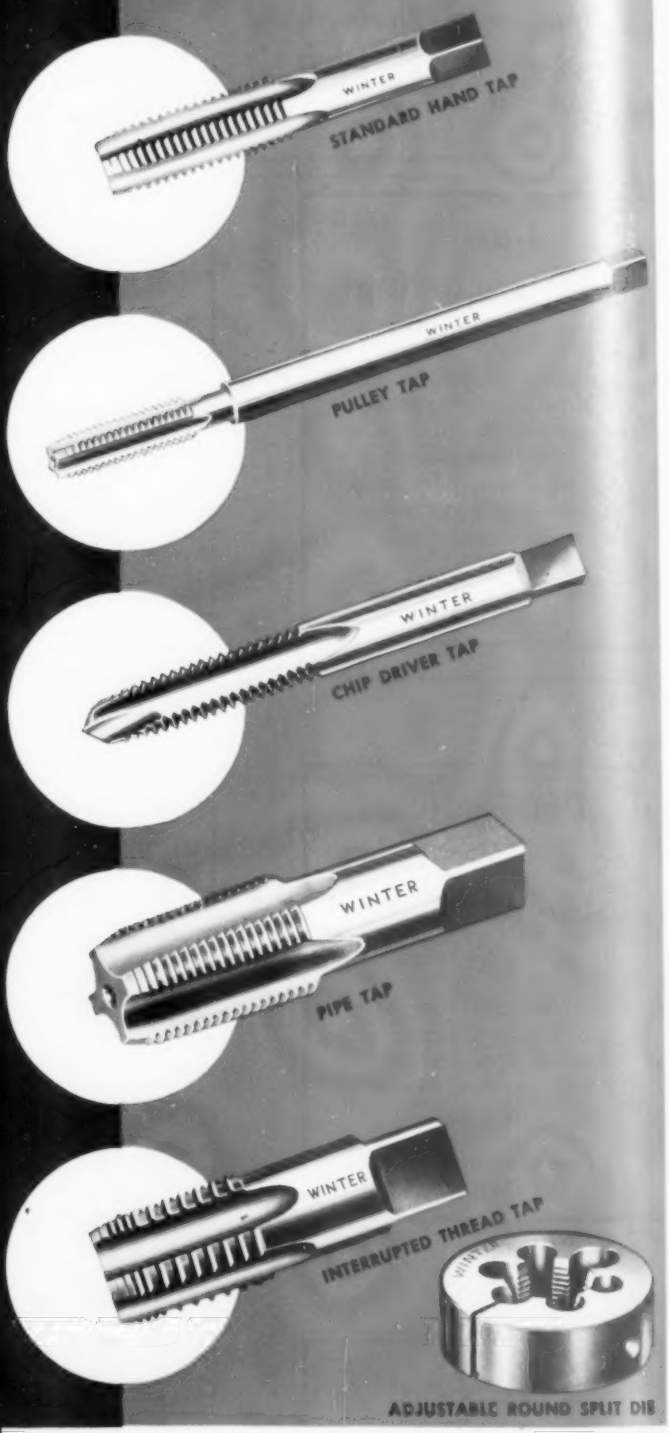

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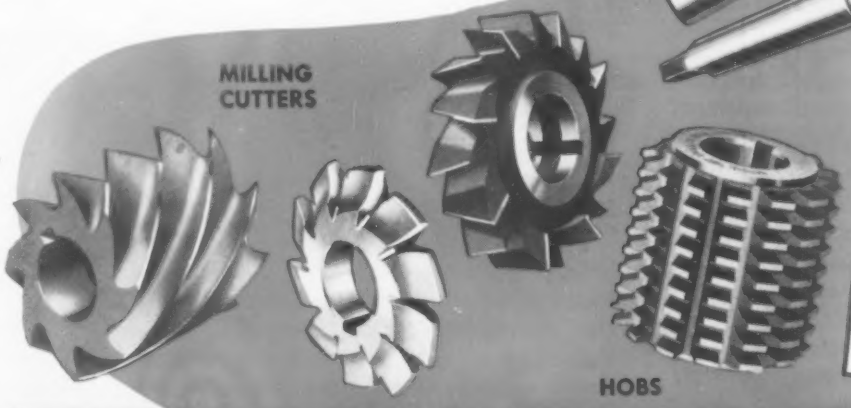

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*The use of Dial Indicator Gages — visible precision — lowers inspection costs, raises production. Federal Products Corporation is America's largest maker of both regular and custom-built gages — mechanical, air, electronic — for the measurement of single and multiple dimensions.

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THE DIAL INDICATOR

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Another application

THE DIAL INDICATOR

accurately measures outside diameters

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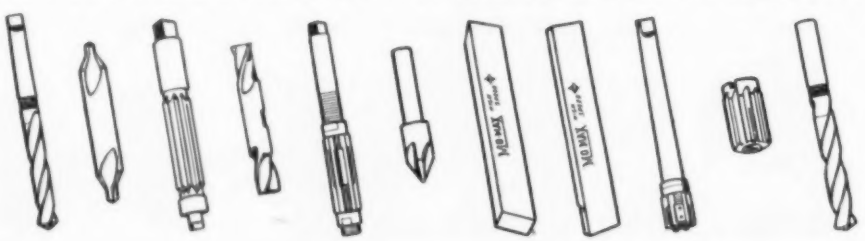

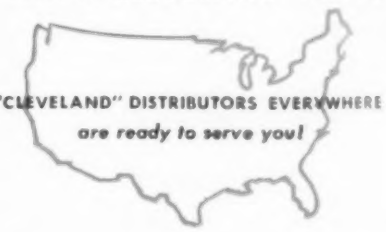

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No other projector gives you this accuracy. With the protractor screen, all angular measurements can be read to ± 1 minute of arc (1′). Direct linear measurements, reading to ± .0001″, can be made by means of the cross slide stage. The projected, magnified image of the object on the ground glass screen is sharp, and well defined.

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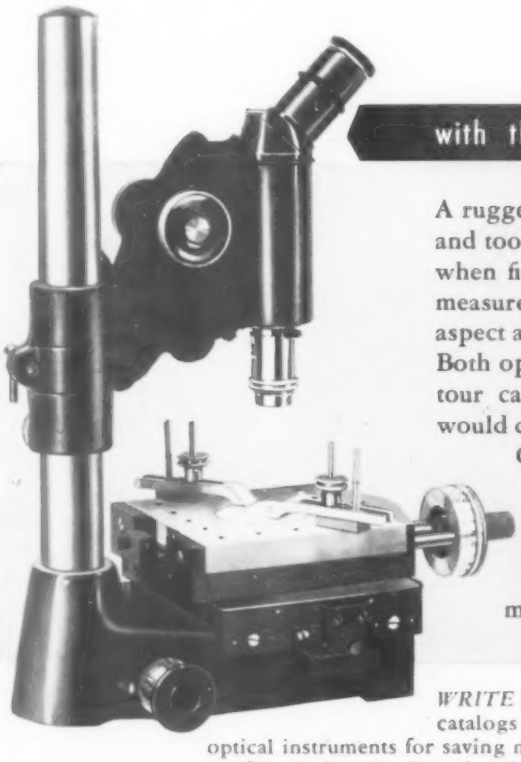

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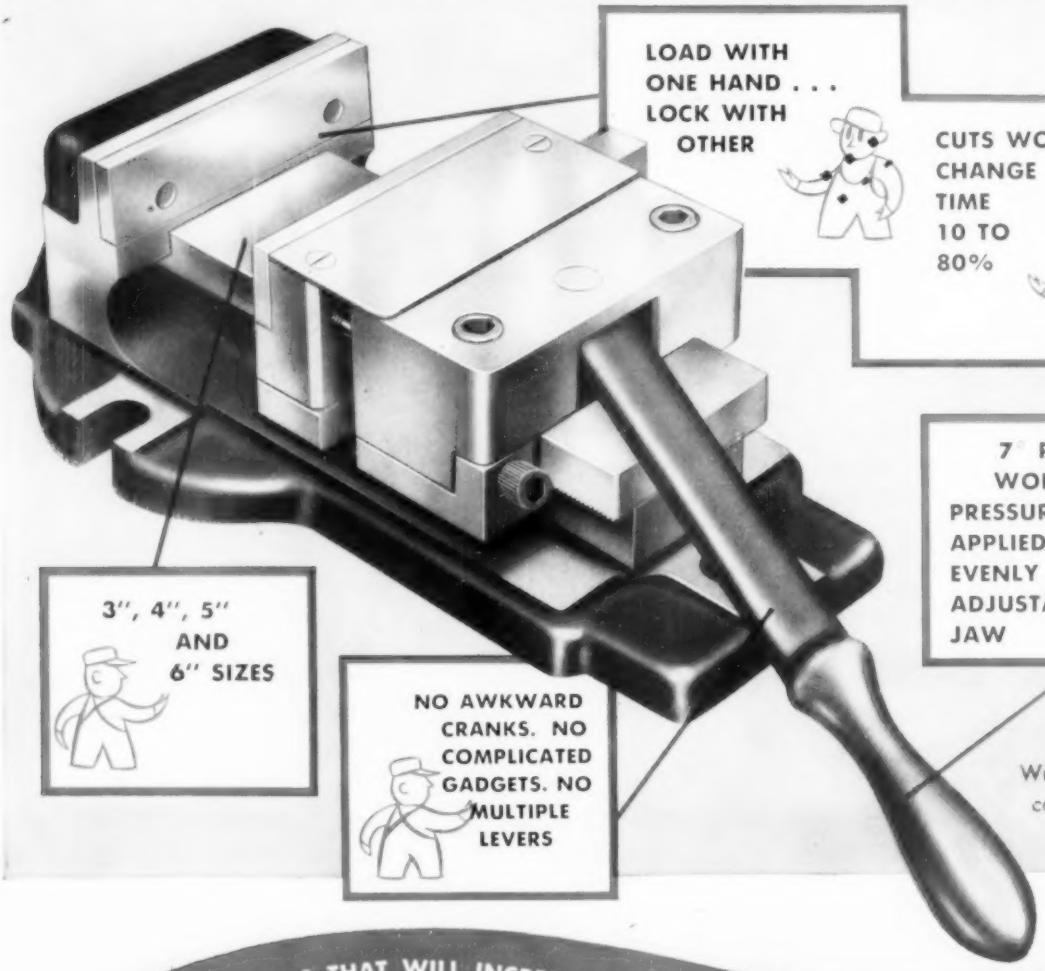

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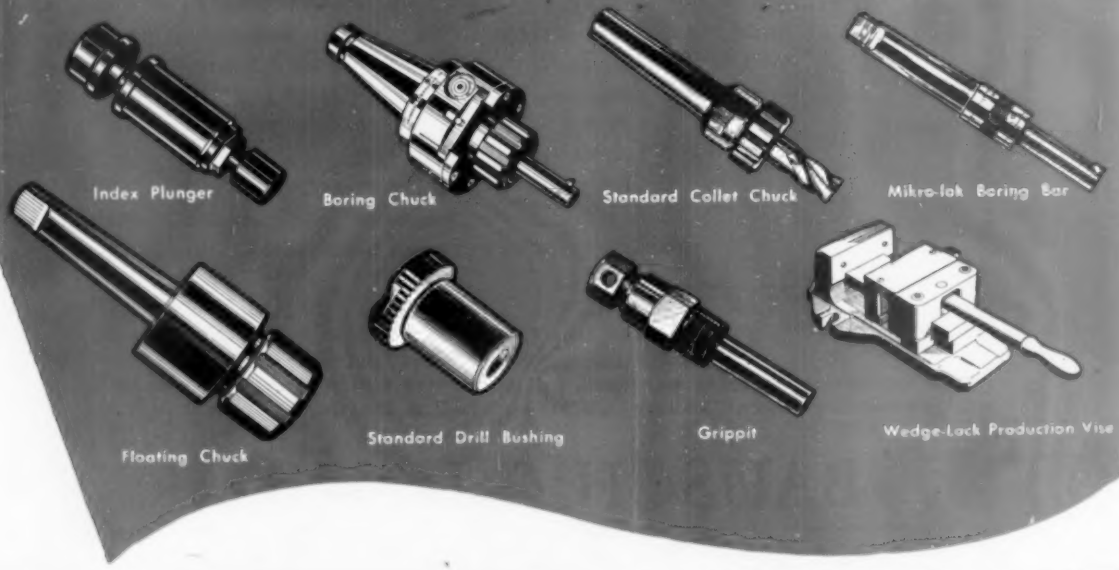

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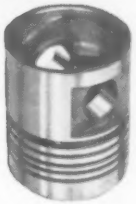
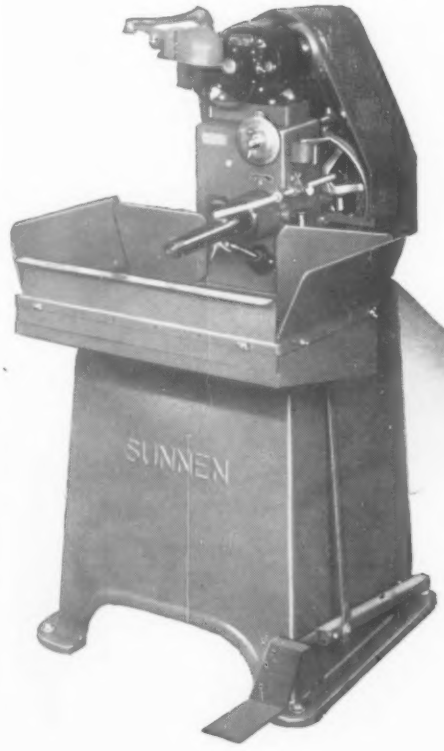
Connecting Rod forging — Hole diameter 1.188", total tolerance, .0005" (five ten-thousandths).



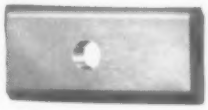
Cast iron piston — Alignment between two holes 1.0625", total tolerance, .0002" (two ten-thousandths). Production 40 pistons per hour.

Bronze fuel injection cylinder — Total tolerance, .00005" (fifty millionths) on diameter of .3125". Production 12 pieces per hour.



Hard steel (60 C scale) governor weight — Total tolerance, .00025" (two and one-half ten-thousandths), diameter .315".

Hard steel (60 C scale) roller — Total tolerance, .0002" (two ten-thousandths), diameter of .2495". Production 40 pieces per hour.



Hard steel (60 C scale) fuel pump cam — Total tolerance, .0002" (two ten-thousandths) on diameter of .250" Production rate 40 pieces per hour.

Sheppard diesel engines are known throughout industry for their dependability, economy and efficiency—achieved by proper design and maintenance of rigid production standards.

On many parts such as those shown here Sunnen Honing holds tolerances as low as .00005" (fifty millionths) or less —at a production rate that is economical in cost.

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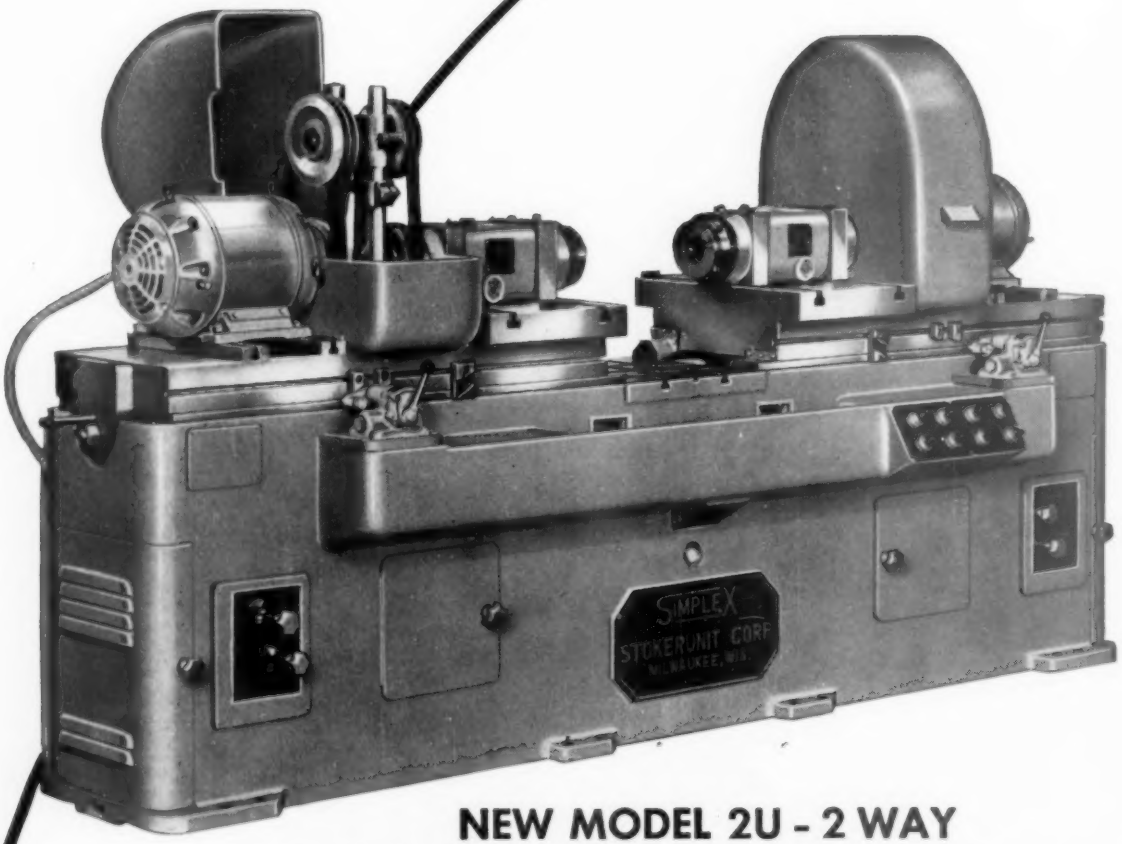
SIMPLEX

A New Concept of Precision Boring Machine Design



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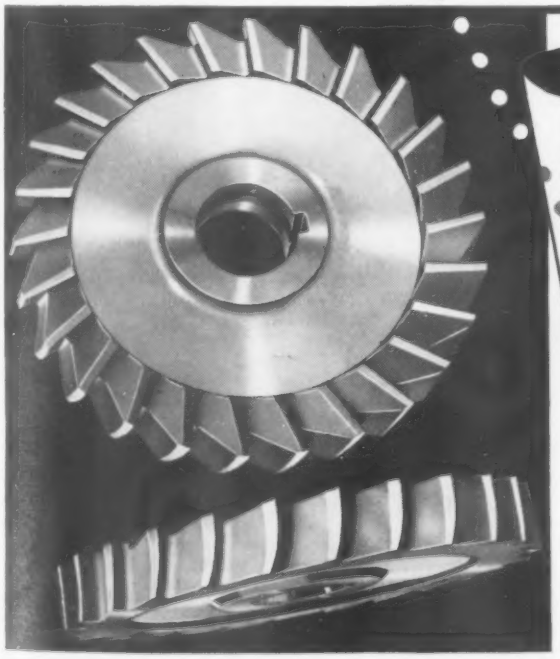
Precision Boring Machines, Planer Type Milling Machines, Special Machine Tools

150 *to* 425

YES . . . in a recent comparative performance test, 150 Aber "Curved Tooth" milling cutters *out-performed* 425 conventional type milling cutters — a 2½ to 1 increase at NO EXTRA COST!

Designed and developed specifically for production men who look to NEW tool designs to reduce top-heavy metal cutting costs, Aber "Curved Tooth" milling cutters operate at speeds 10% to 25% faster than standard straight tooth milling cutters in addition to providing smoother finishes and close to tolerance operations. Utilizing the most outstanding tooth design developed in the past decade, Aber Engineering Company produces a complete line of quality milling cutters featuring the "Curved Tooth" principle.



A TYPICAL ABER "CURVED TOOTH" PERFORMANCE

OPERATION: Milling lugs on plate. Slotting and side milling parallel sides.

MACHINE: Cincinatti 3-Spindle Mill.

TOOL SETUP: (1) R. H. and L. H. Shear Side Milling Cutter.
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Feed: 10-1/2"

PERFORMANCE: 16-1/2 hours between grinds. Best previous practice with conventional, straight tooth H. S. S. milling cutters was 6-1/2 hours between grinds.

KEEP UP TO DATE with tool design progress. Write today for more detailed information on the ABER line of "Curved Tooth" milling cutters.

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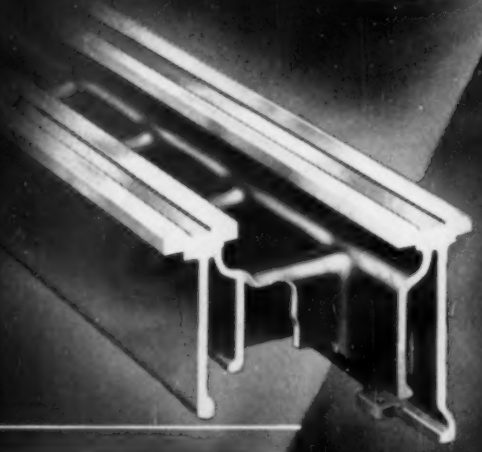
SIDNEY BONUS* DESIGNED LATHES



All herringbone geared headstock provides 32 pre-selective changes of spindle speeds through convenient dial control. Spindle and intermediate shafts are equipped with center bearings in addition to end bearings. Spindle mounting automatically compensates for expansion caused by temperature rise.

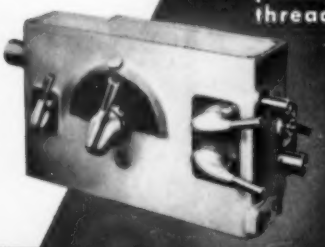
*BONUS...

"Something given in addition to what is usual or strictly due"

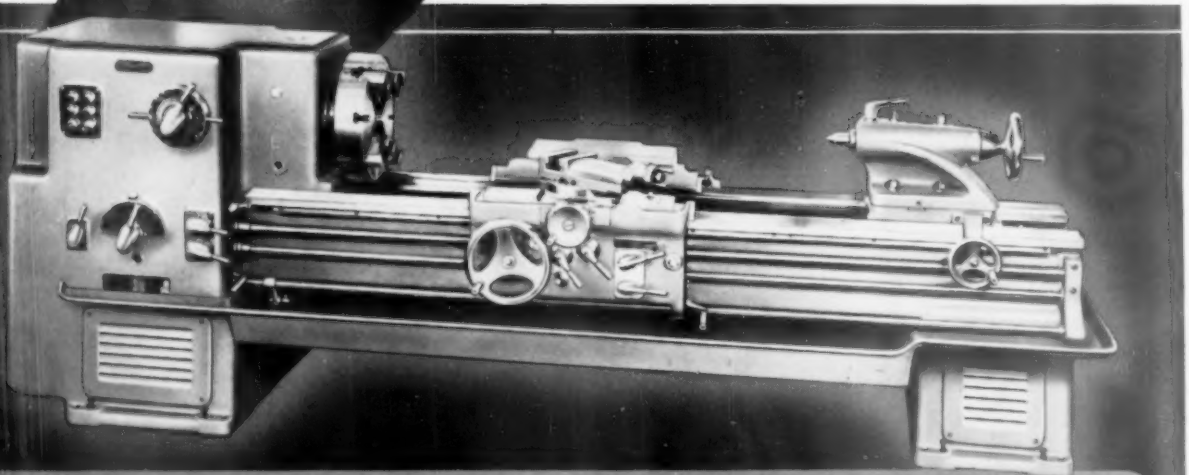
... *Webster's Dictionary*

Rigid four-wall bed construction with double cross girts spaced at 12" intervals. Casting is of semi-steel nickel mixture for close grain structure.

Sidney's totally enclosed dial controlled gear box provides 60 changes of threads and feeds. All moving parts run constantly in oil.



● More and more manufacturers are taking advantage of the many outstanding construction features of Sidney Lathes that give them precision work — greater production — lower costs. That's why we call it Bonus Designed.



SIDNEY MACHINE TOOL COMPANY • SIDNEY, OHIO

Builders of Precision Machinery Since 1904

the grinding job

Cutting-off 1¼" Hex Hollow Drill Steel to various lengths on a high speed abrasive cut-off machine. This is a continuous production job where fast cutting action and long wheel life are essential.

the wheel

Borolon resinoid A30-S7-B1, 14" x 1/8" x 7/8", adopted as standard for this job because of its exceptionally efficient performance. Withstands the severe stress and strain of high speed operation. Ideal for cutting steel and alloy steel bars, rods, angles, tubing, etc.

Borolon — ALUMINUM OXIDE

Electrolon — SILICON CARBIDE

SIMONDS ABRASIVE CO.

PHILADELPHIA, PA.

Grinding Wheels

Complete line includes every shape and size.

Abrasive Grains

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Bricks and Sticks

Available Everywhere

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From your Simonds Abrasive Company distributor, member of our distributor network serving key industrial centers here and abroad. He stocks Simonds Abrasive Company Grinding Wheels for every job and can advise you on wheel selection. Let us send you the name of the distributor in your area. Write now.

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For the utmost wheel efficiency on every grinding job from roughing to finishing you can count on Simonds Abrasive Company Grinding Wheels—products backed by their manufacturer's experience as a leading producer of grinding wheels and abrasives exclusively, for over 50 years—products quality controlled from the crude abrasive produced in modern electric furnaces by Simonds Canada Abrasive Company, Ltd., to the finished wheels available through our industry wide distributors. For consistently high quality results use Simonds Abrasive Company Grinding Wheels.

SIMONDS ABRASIVE COMPANY, PHILADELPHIA 37, PA. • DISTRIBUTORS IN ALL PRINCIPAL CITIES

Partial view of the D. A. Stuart Oil Co. laboratory where the "straight line to metal working efficiency begins."

Skillful Application of Job-Proved Cutting Oils

Metal cutting problems call for the best use of available skills and tools. The most profitable use of cutting fluids can only result from the close cooperation of the machine-operating engineer and the skilled and experienced cutting fluid service representative, backed by complete laboratory facilities.

The Best Combination To Help Solve Machining Problems

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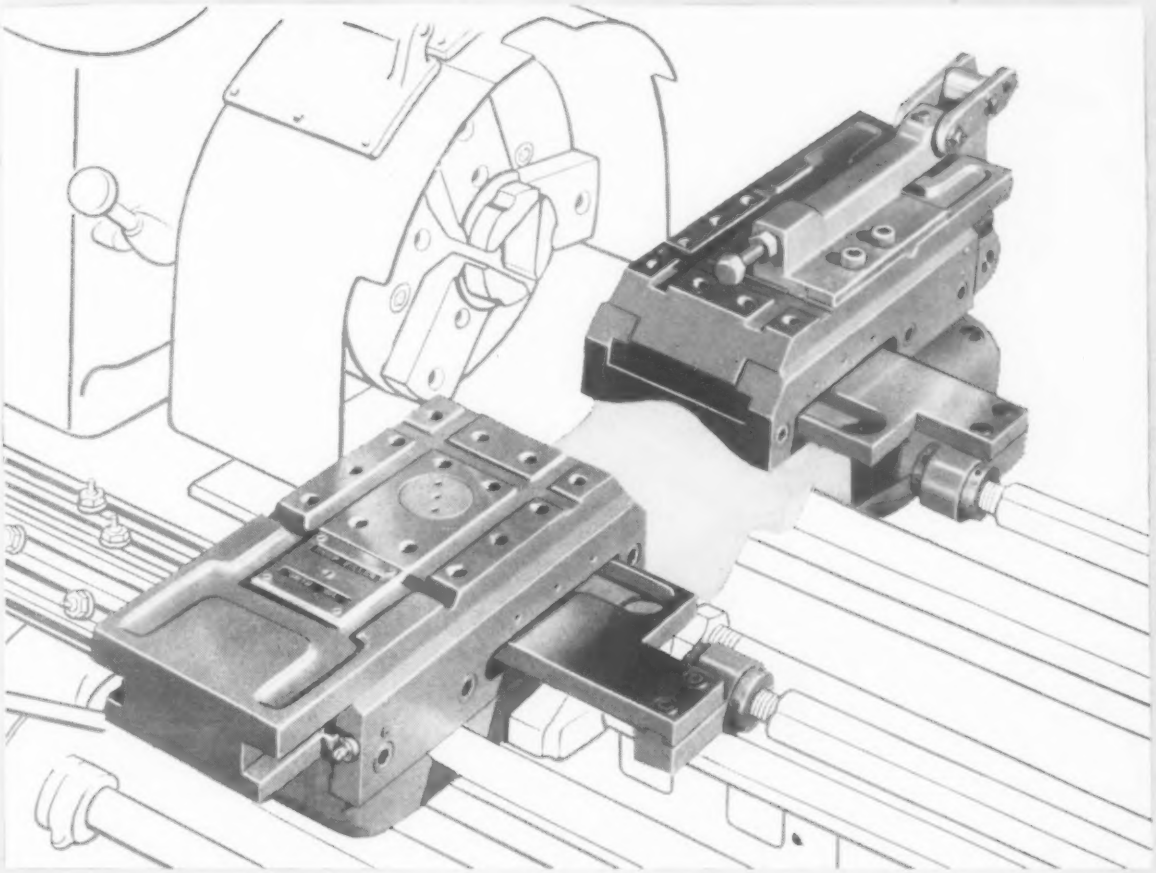
The Straight Line To Metal Working Efficiency

STUART *service goes with every barrel*

GISHOLT FASTERMATICS

(Automatic Turret Lathes)



Separate front and rear cross-slides permit independent or simultaneous operation . . . providing utmost flexibility in tooling setups

. . . GREATER PRODUCTION*

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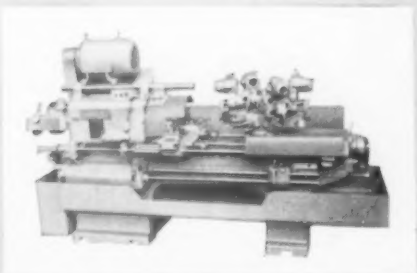
Madison 3, Wis.

THE GISHOLT ROUND TABLE represents the collective experience of specialists in machining, surface-finishing and balancing of round or partly round parts. Your problems are welcomed here.

TURRET LATHES • AUTOMATIC LATHES

SUPERFINISHERS • BALANCERS • SPECIAL MACHINES



* Each of the Fastermatic's independent cross-slides can be used as many times as necessary within the turret cycle. Thus, you can do more different jobs.

First Fully AUTOMATIC LOADER For Gear Shaving Machines

● The Red Ring Automatic Loader, the first practical unit of its kind to be developed, has greatly increased the economy of the gear shaving operation. Equipped with such loaders, a battery of shaving machines can be kept in continuous operation by one man whose only duty is to keep their magazines loaded with work gears. That requires no skill.

Loading, clamping, shaving, unclamping, unloading and the final discharge of the finished gear are all automatic and fully protected by a safety mechanism. This is another significant accomplishment by the Red Ring organization which is today the world's largest manufacturer of gear shaving equipment.

The gear shown in the illustration here is an overdrive transmission planet pinion having 12 teeth, 13.5 D.P., 20° P.A., 1" P.D. and a 1" face. Actual shaving time is 11 seconds, loading and unloading 2.3 seconds or a total of 13.3 seconds for the complete cycle. This gives a production of 270 parts per hour. Stock removal is .005" over pins.

The Automatic Loader is applicable to Red Ring Shaving Machines GCV and GCU for automotive transmission gears or similar units. For further details and quotation, call a Red Ring Engineer.

"World's Largest Producer of Gear Shaving Equipment"

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Patrick Henry speaking before the Second Revolutionary Convention of Virginia in 1775.

RESULTS... speak for themselves!

True, Patrick Henry's famous speech got results—men were inspired to fight for a free and independent nation . . . yes, and Bay State's Mounted Wheels and Points get results too—results that speak for themselves.

There are very definite reasons for such superiority.

1 — Will not break loose from spindles
2 — Consistent hardness — no soft spots
3 — Shaped on spindles — run absolutely true
4 — Ready for immediate cutting action
5 — Unique treatments are available to prevent loading on certain types of jobs
6 — Service life is longer — can be used right down to the mandrel

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BAY STATE®

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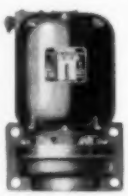
BAY STATE ABRASIVE PRODUCTS CO., WESTBORO, MASSACHUSETTS, U. S. A.

PUMPS SUMPS DRY

The compact design of this Pioneer Coolant Pump, Model VBA, allows it to be installed in sumps, or pans, that are practically flush with the floor . . . designed to get the most out of a restricted or small sump base, it will empty the sump to the very bottom . . . efficiently handles coolants containing large chips or shavings . . . standard models available in capacities of 13-148 gallons per minute.

PIONEER MODEL VBA



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400 MODELS

FOR LUBRICANTS AND COOLANTS

Pioneer Pumps in Seal-type, Seal-less and Rollway designs for pumping coolants, cutting fluids, abrasive liquids, lubricants and water available in every desired type and size. Please specify your needs when writing for information.

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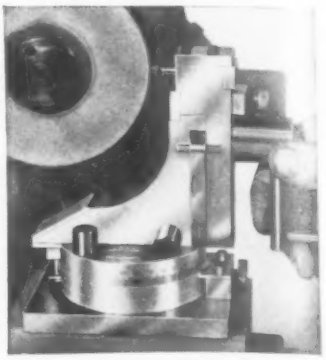
★ ★ ★ *Fluidmotion*®

Simplest and Most Accurate Method of

FORM-DRESSING



● "Fluidmotion" Wheel Dressers generate wheel profiles in such a way that angles and radii flow into each other, without sharp changes of direction. Two angles and a radius can be dressed in one continuous motion—after only one setting of the dresser. "Fluidmotion" Dressers are made of the the finest chromium-molybdenum-vanadium alloy steels and have no wearing surfaces, as the gibs and V ways are positioning surfaces only and the dresser swivels on completely dust-protected ball bearings. Several models available. Model F, illustrated, is the smallest. 5" height to diamond center, dresses wheels up to 7" in diameter, profile radius up to 2". Write for booklet.

*Reg. U. S. Pat. Off.

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485 Main Street, East Orange, N. J.
Representatives in Principal Cities

"Cone-Lok" JIGS

The Woodworth "CONE-LOK" jig utilizes the full braking power of its perfectly mated male and female cones.

ACCURACY YOU CAN TRUST

• MECHANICAL SIMPLICITY • ADAPTABILITY
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N. A. WOODWORTH COMPANY
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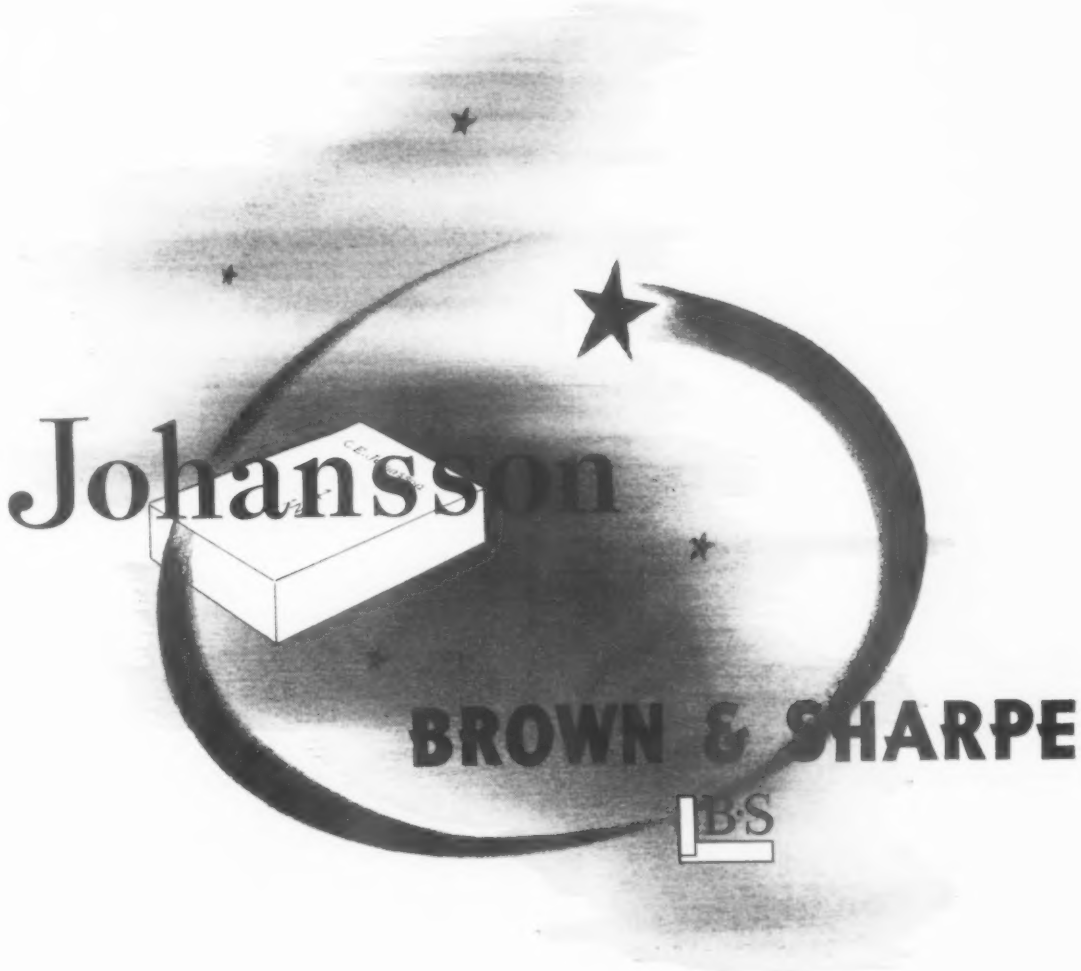
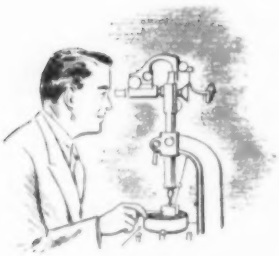
An Important Merger of Two Great Names in Precision



All Ford interests in World-famous Johansson Gage Blocks now acquired by BROWN & SHARPE from the FORD MOTOR COMPANY



★ On June 3, 1948, Brown & Sharpe Manufacturing Company purchased the Johansson Division from the Ford Motor Company, with all rights to manufacture and distribute Johansson Gage Blocks and Accessories throughout the Western Hemisphere. In achieving this transfer, Brown & Sharpe is fully aware of the great responsibility that goes with it . . . a responsibility for maintaining an unprecedented standard of precision which Ford shouldered faithfully for 25 years.

Now, into one identity, are merged two of the world's great names in precision measuring tools . . . *Johansson*, the name that carried new precision into mass production of interchangeable parts . . . and *Brown & Sharpe*, the name that has symbolized leadership in the development and manufacture of precision measuring devices, machines and tools for more than 100 years.

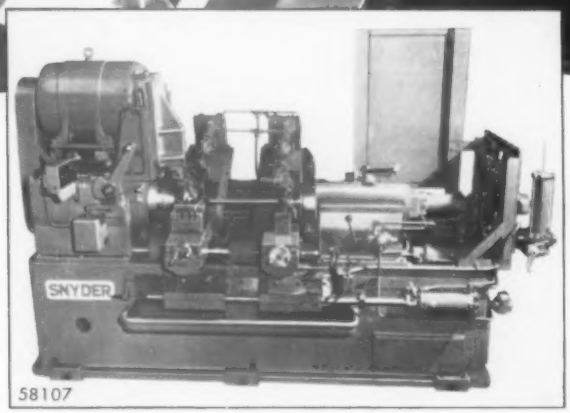
Brown & Sharpe has acquired special equipment and processes including a stock of thoroughly-seasoned Johansson Gage Blocks and Accessories. This stock will be available to supply industry's requirements until Brown & Sharpe is in production of full-standard Johansson Gage Blocks and Accessories in special quarters at its own plant in Providence.

The Brown & Sharpe name is industry's guarantee that the traditional precision of Johansson Gage Blocks will be maintained without compromise.

B·S

BROWN & SHARPE MFG. CO., PROVIDENCE 1, R. I., U.S.A.

Look ahead with Snyder!



AXLES will cost less because of this SNYDER LATHE

Nine and a half tons of rigidity, speed and accuracy, this special lathe, designed and built by Snyder, uses newest developments in clamped-on, round, triangle and other shaped carbide tools to turn out 75 to 80 pieces an hour at 80% efficiency.

As shown, the machine is tooled for turning and facing rear axle shafts and in one operation finishes all diameters and faces to size (except for grinding stock on the bearing and oil seal diameters). It also can be applied to a wide range of other parts with minimum change-over. Center drive unit and other attachments can be added any time.

All feeds are hydraulic, quickly adjustable by dials for each attachment. Spindle speeds are controlled by readily accessible pick-off gears. All moving parts are automatically lubricated. Work cycle is automatic.

Money saved through HIGHER production efficiency is clear profit. Maybe Snyder can help you. Write *Snyder Tool & Engineering Co., 3400 E. Lafayette, Detroit 7, Mich.*

SNYDER SPECIAL MACHINES CONTROL COSTS

23 Years of Successful Cooperation with Leading American Industries

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★ THREAD GENERATORS

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★ INVOLUTE MEASURING INSTRUMENTS

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★ FELLOWS CUTTERS AND SHAVING TOOLS

★ PLASTIC INJECTION MOLDING EQUIPMENT

FELLOWS

A name famous for leadership in the design and manufacture of gear cutting equipment since 1896, serving the shops of America through a sales-service and engineering organization readily available at any one of the following addresses:

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Head Office & Export Dept.
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Branch Offices:
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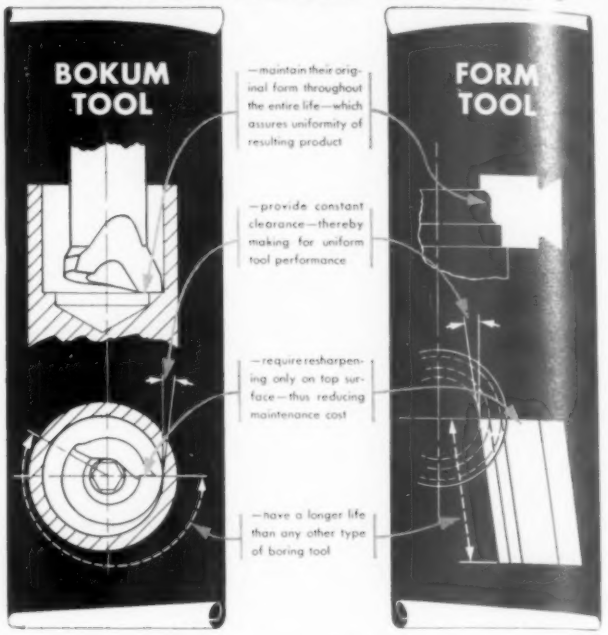
MACHINES AND TOOLS FOR ALL OPERATIONS FROM BLANK TO FINISHED GEAR

Like external form tools

BOKUM BORING TOOLS


BOKUM TOOL
FORM TOOL
—maintain their original form throughout the entire life—which assures uniformity of resulting product
—provide constant clearance—thereby making for uniform tool performance
—require resharpening only on top surface—thus reducing maintenance cost
—have a longer life than any other type of boring tool

AVAILABLE IN 3 STYLES { STYLE A — for general boring; STYLE B — for facing and bottoming; STYLE C — for internal threading

Ask for catalog T-1139 for super high speed tools—and T-398 for carbide-tipped

TRADE MARK REG. U. S. PAT. OFF.

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SINGLE POINT BORING TOOLS—INTERNAL THREADING, BOTTOMING AND FACING TOOLS—CARBIDE TIPPED TOOLS

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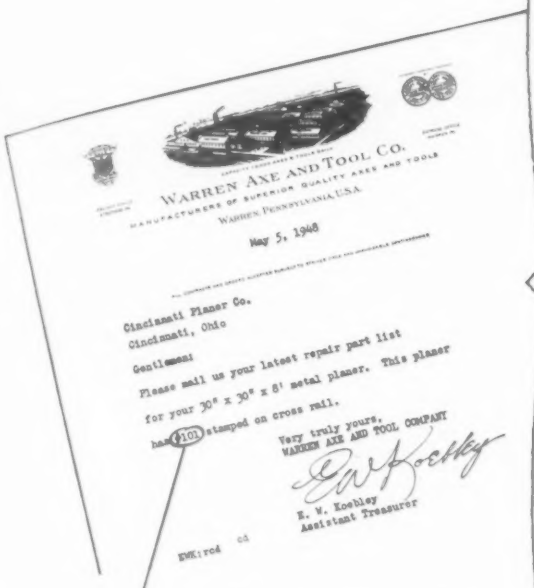
50 years



WARREN AXE AND TOOL CO.
MANUFACTURERS OF SUPERIOR QUALITY AXES AND TOOLS
WARREN, PENNSYLVANIA U.S.A.

May 5, 1948

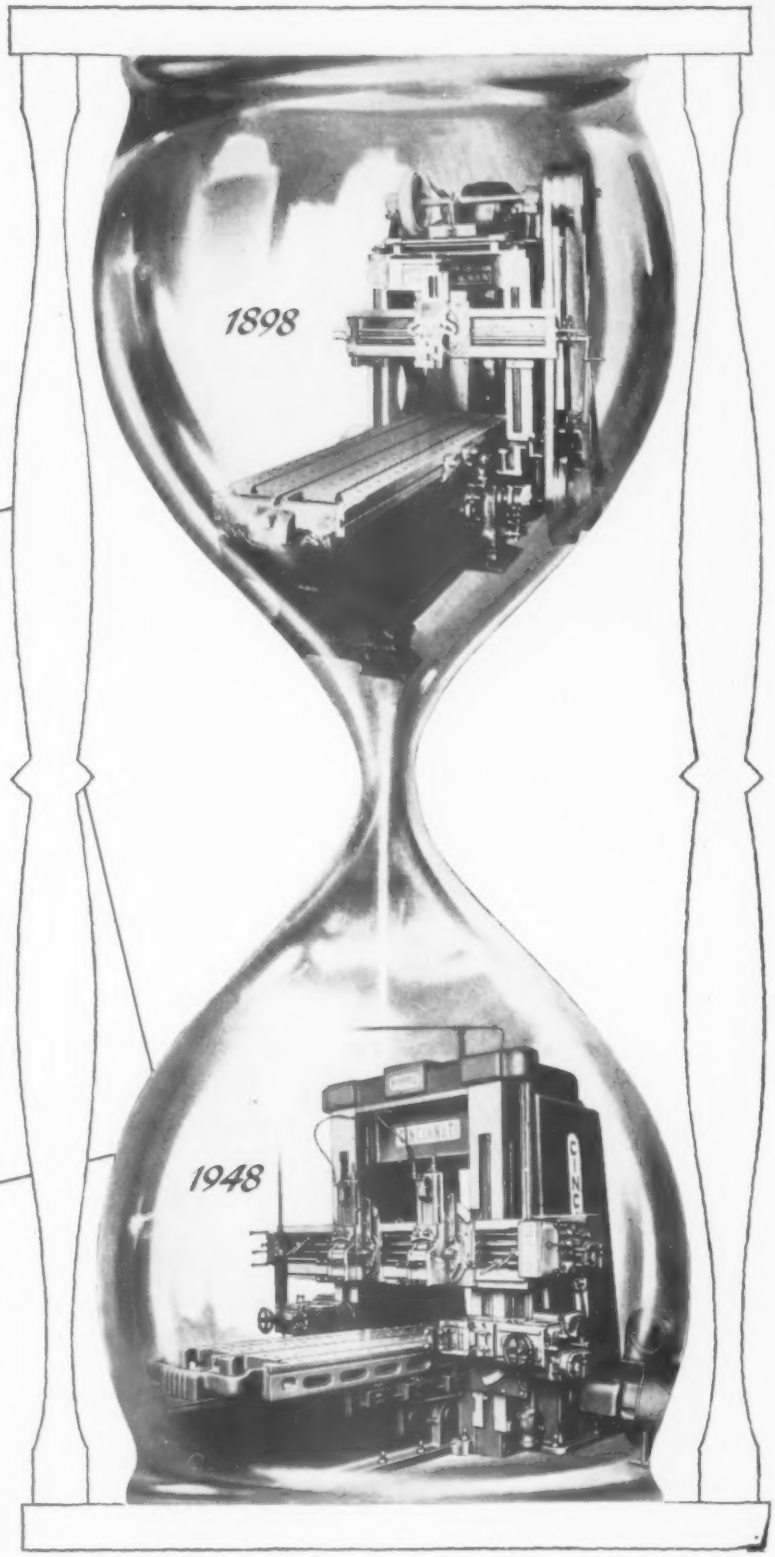
Cincinnati Planer Co.
Cincinnati, Ohio

Gentlemen:

Please mail us your latest repair part list for your 30" x 30" x 8' metal planer. This planer has #101 stamped on cross rail.

Very truly yours,
WARREN AXE AND TOOL COMPANY
E. W. Koebley
Assistant Treasurer

EWK:rcd



No. 101 was the first Planer manufactured by the Cincinnati Planer Company. They made a good Planer in 1898 of highest quality and finest workmanship which has stood the test of time.

Today we make an even better Planer. The modern Cincinnati HYPRO Planer, still retaining all of the Hypro-duction features and craftsmanship developed through years of experience, has been improved to incorporate new and exclusive features such as centralized finger-tip control for the complete operation of the machine, all steel hardened "twin" helical gear train, double nuts on both saddle and down slide screws, inverted dovetail slides, double acting tool block abutment, centralized dual saddle control and precision adjustment handles. These features provide increased production, lower planing costs and convenience to the operator.

Bulletin No. 138 will give you complete specifications. Write for it today.

THE CINCINNATI HYPRO PLANER COMPANY

PLANERS · BORING MILLS · PLANER TYPE MILLERS

CINCINNATI, OHIO

Reduce the COST OF TOOLING

You can convert spindles to larger or smaller tapers—and extend the spindles in your present Drill Presses, Radial Drills, Turret Lathes, Boring Mills, etc.—to utilize their productive capacity to a greater extent.

IMMEDIATE DELIVERY
ON ALL POPULAR SIZES

LONGER WEAR AND BETTER PERFORMANCE

Made to exact specifications. The tang and hole ends are heat-treated for longer wear and maintenance of concentricity. They will outlast the ordinary soft sockets and perform with greater accuracy.

FURNISHED WITH MORSE TAPER HOLES AND SHANKS *Three Series* LONG • MEDIUM • SHORT

For details see page 215 in Scully-Jones Tool Engineering Manual 500 which shows over 500 types and sizes of cutting tools, collet chucks, boring equipment, centers, etc.

Write for a folder on Extension Sockets.

Scully-Jones AND COMPANY

1915 SOUTH ROCKWELL STREET, CHICAGO 8, ILLINOIS

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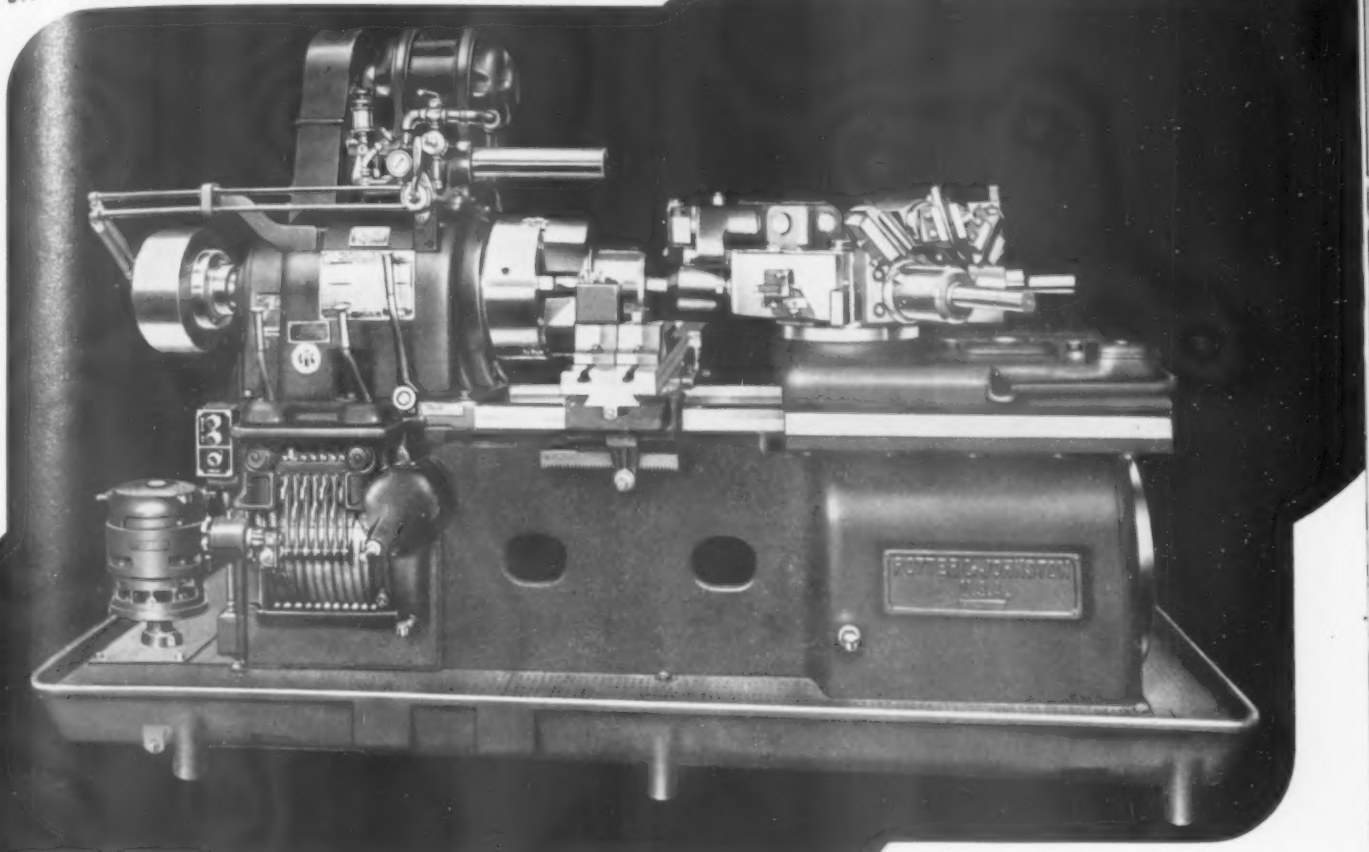
CAREFULLY DESIGNED TO DO THE WORK AND



5D POWER-FLEX AUTOMATIC TURRET LATHE

SPECIFICATIONS

		5D standard	5DE elevated	5DLX long travel and extended	5DELX
BED	swing over	25"	30"	25"	30"
CROSS SLIDE	swing over	12"	17"	12"	17"
	travel each way	5"	5"	5"	5"
TURRET	no. of faces	5	5	5	5
	slide travel	13"	13"	16"	16"

Frankly, a powerful automatic turret lathe costs a great deal of money. Aside from the excellence of the work it produces, it should earn its own way and kick back a substantial profit. Potter & Johnston's 12,500 lb. 5D POWER-FLEX AUTOMATIC TURRET LATHE meets all these requirements. Powerful and rigid, it has 4 automatic changes of spindle speed while under cut; 3 selective automatic changes of feed; automatic binding of the turret following index; powerful, direct cross slide action and a constant high speed rapid traverse motion to the cross slide and turret slide. All these factors contribute toward greater flexibility and higher productive capacity. The 5D POWER-FLEX is provided with a pan base which serves as a coolant reservoir when required. The increased first cost of this construction is amply justified by the resulting permanency of alignment, freedom from scoring, and long life. Send us a blueprint of a casting or forging and we will tell you to the fraction of a penny the cost of machining it on the 5D POWER-FLEX. From that point on you can figure the advantages of the 5D yourself.

POTTER & JOHNSTON CO.
PAWTUCKET, RHODE ISLAND
Subsidiary of
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Division Niles—Bement—Pond Company

Here's the New AIR PRESSURE REGULATOR

—That Pays for Itself!

HANNIFIN
AIR WARDEN
REGULATOR

SPEEDS UP PRODUCTION! You get fast action with Hannifin's new "Air Warden" regulator. No slow build-up to desired pressure. Saves time; helps do work faster.

SAVES AIR! Easy to back off air pressure without exhausting control valve. Instant downward pressure adjustment merely by turning control knob.

EXACT PRESSURE CONTROL. Accurate, sensitive; secondary pressure setting repeats exactly regardless of fluctuating flow conditions. For use on primary air pressures up to 150 p. s. i. Maintains any desired secondary pressure from 5 to 125 p. s. i. even under dead end conditions.

FINE QUALITY. Small, compact, and moderately priced, but unexcelled for precision construction. Nylon valve seats. Instrument type control knob and fine threaded adjusting screw. All non-corrosive materials. Built-in fine mesh bronze strainer. Sizes ⅜" and ½".

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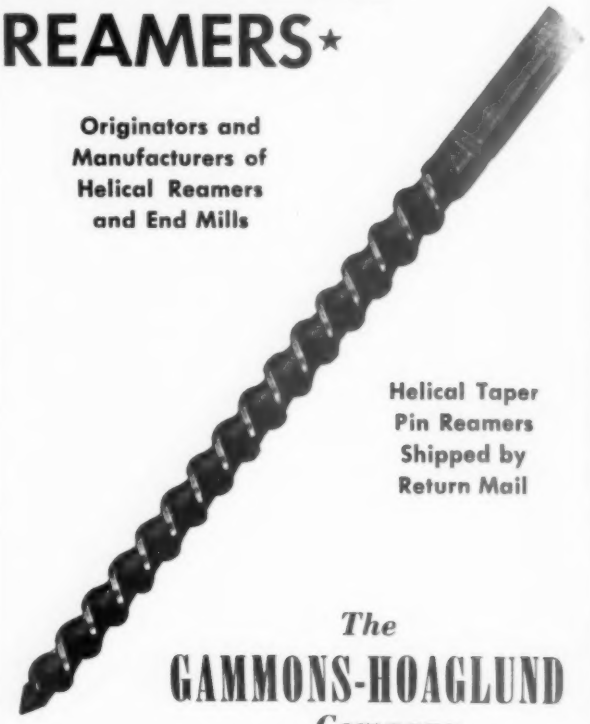
GAMMONS REAMERS★

Originators and Manufacturers of Helical Reamers and End Mills



Helical Taper Pin Reamers Shipped by Return Mail

The
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Company

400 MAIN STREET, MANCHESTER, CONN.

Columbia TOOL STEEL

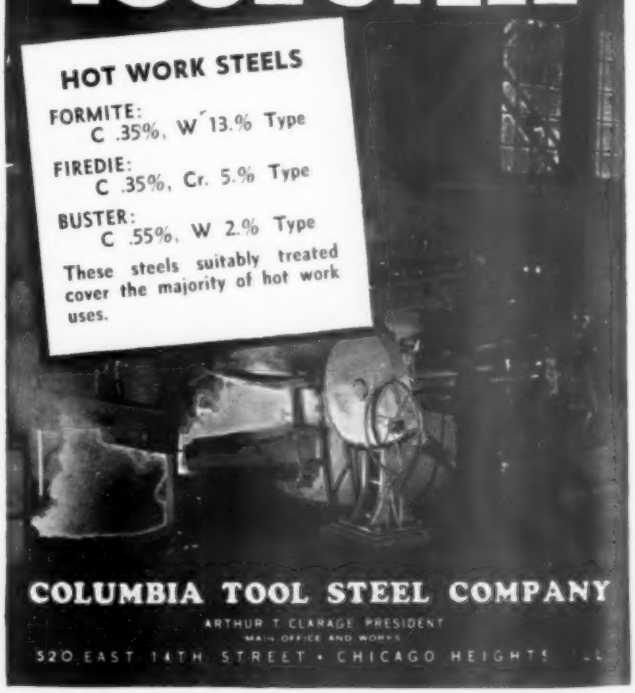
HOT WORK STEELS

FORMITE:
C .35%, W 13.% Type

FIREDIE:
C .35%, Cr. 5.% Type

BUSTER:
C .55%, W 2.% Type

These steels suitably treated cover the majority of hot work uses.



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ARTHUR T. CLARAGE, PRESIDENT
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CHECK WORK by .0001" to .00001" AS FAST AS FINGERS CAN FLY

Production gaging with External Comparator No. 951 and Amplifier 950.

with this UNIQUE *Electronic* MEASURING EQUIPMENT

ADVANCED design and construction features make this Brown & Sharpe Measuring Equipment unusually fast, accurate and dependable. Its separate amplifier, for example, completely isolates heat-producing elements . . . thus prevents temperature drift in gaging units. Its true linear response permits accurate setting for the entire scale with only one master block. A single amplifier may be used to serve several separate testing instruments. Line voltage fluctuations within the range of 105 to 125 volts do not affect readings.

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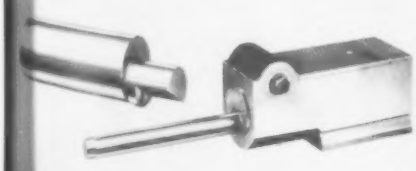
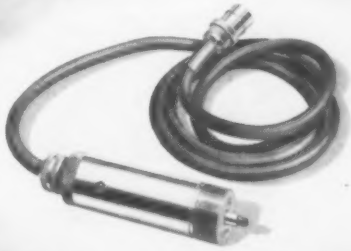
We urge buying through the Distributor



Speedy Internal Gaging from ½" to 2" is provided by Internal Comparator Attachment No. 952. For use with External Comparator No. 951.

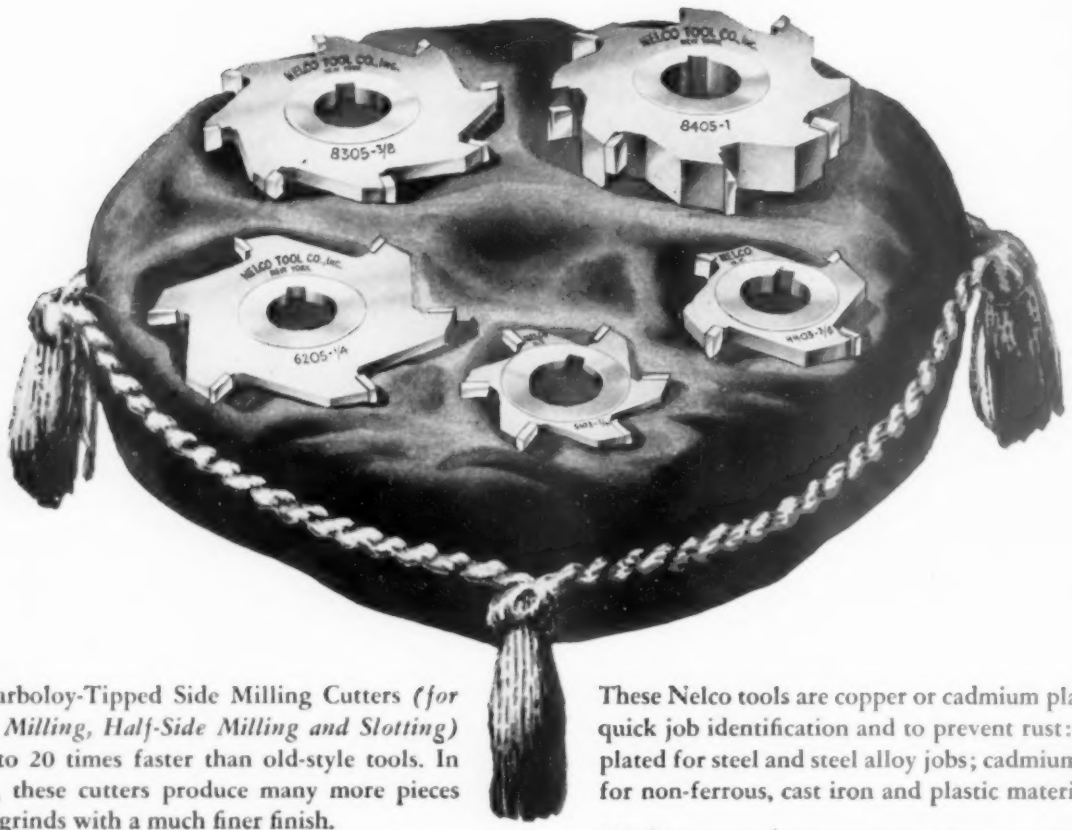


Extremely Accurate Gaging (.0001" to .00001") in stands, jigs and fixtures is offered by Gage Head Cartridge No. 953. Plugs in directly to Amplifier No. 950.

Visual Indication of work conditions show quickly on Signal Light Attachment No. 958. For use with Amplifier No. 950. Easily attached.

BROWN & SHARPE

For That Extra Edge In Production



Nelco Carboloy-Tipped Side Milling Cutters *(for Straddle Milling, Half-Side Milling and Slotting)* mill up to 20 times faster than old-style tools. In addition, these cutters produce many more pieces between grinds with a much finer finish.

Designed by craftsmen with custom-built precision that insures better production and workmanship, Nelco Side Mills have all-alloy steel bodies . . . thicker, sandwiched-brazed, diamond-ground tips that assure longer tool life and more regrinds.

These Nelco tools are copper or cadmium plated for quick job identification and to prevent rust: copper plated for steel and steel alloy jobs; cadmium plated for non-ferrous, cast iron and plastic material jobs.

All these extra features at no extra cost are found only in Nelco Carboloy-Tipped Side Milling Cutters . . . manufactured in sizes from 3″ to 8″ dia. and 1/8″ to 1″ width, and are available from stock. All Nelco tools are shipped individually protected by a plastic coating.

SAVE Hundreds of Valuable **PRODUCTION HOURS** By Giving The **NELCO FIELD ENGINEER** A Few Minutes Time!

On Request!

Your copy of this new 28-page catalog illustrating and describing the complete line of Nelco Carboloy-Tipped Cutting Tools. Includes valuable engineering data and price lists. Send for it today.

NELCO TOOL CO., INC.

For That *EXTRA EDGE* In Production

Executive Offices and Plant

266 Center Street Manchester, Conn.

Any One of These Well Known Distributors Will Be Glad To Serve You

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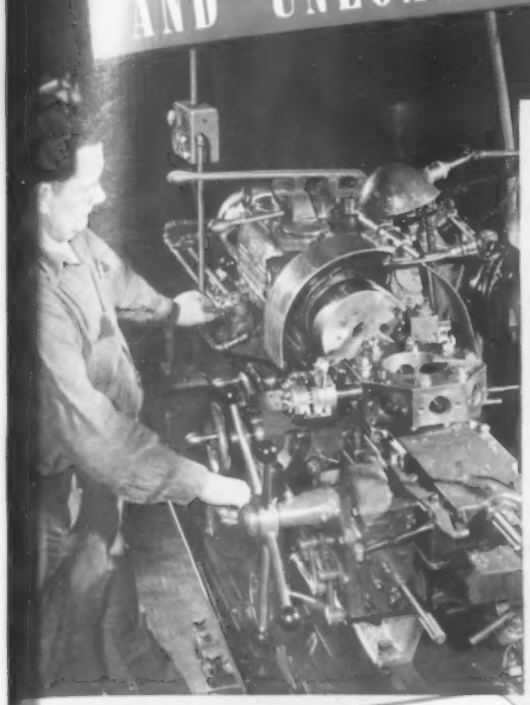
ELBOW-SHAPED PART LOADED, CHUCKED ON CENTER AND UNLOADED IN . . . . . 2.4 SEC.

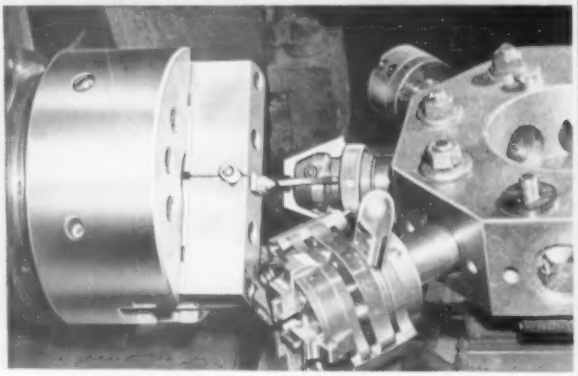


USING STANDARD *"LOGAN"*

AIR-OPERATED CHUCK

(2-JAW UNIVERSAL TYPE WITH BLANK JAWS SPECIALLY FORMED TO HOLD THIS WORKPIECE

and Complete "LOGAN" Air Equipment



Just 2.4 seconds are required for loading, chucking and unloadin of a difficult-to-hold part in this turret lathe job. The complete Loga air-operated chucking installation is an important factor in completin multiple operations with the required precision and speed necessary t maintain production schedules. The workpiece, an elbow-shaped bra valve body, can be positioned accurately and instantaneously in t specially formed blank "false jaws" of the chuck.

Chuck jaws are closed and opened by moving the lever of the co venient control valve. The continuous, equalized jaw pressure preven work distortion and automatically eliminates work-holding failure Important savings are obtained in operating and machine time, an production is profitably increased.

FREE ENGINEERING HELP—Submit your chucking problems t Logan engineers. Recommendations will be made and layouts fu nished. No obligation for this service.

THIS COMPLETE LOGAN AIR SYSTEM INCLUDES:

Standard 2-Jaw Universal Chuck—Complete range of types for both air and hydraulic operation also available.

Blank Chuck Jaws—Furnished in soft .15-.25 carbon steel, suitable for standard carburizing heat treatment after machining to fit a particular workpiece.

Rotating Air Cylinders—Air and hydraulic rotating cylinders available in standard, open-center (for coolant pipe) and high speed models.

Hand-Operated Air Valve—Air and hydraulic control valves also offered in types for hand, foot, cam, electric solenoid, pilot and latch operation.

Logan R-F-L Unit (air regulator-filter-lubricator)—Maintains uniform air pressure; filters out foreign matter and supplies oil mist to lubricate air-control valve and air cylinder.

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Air and Hydraulic Equipment

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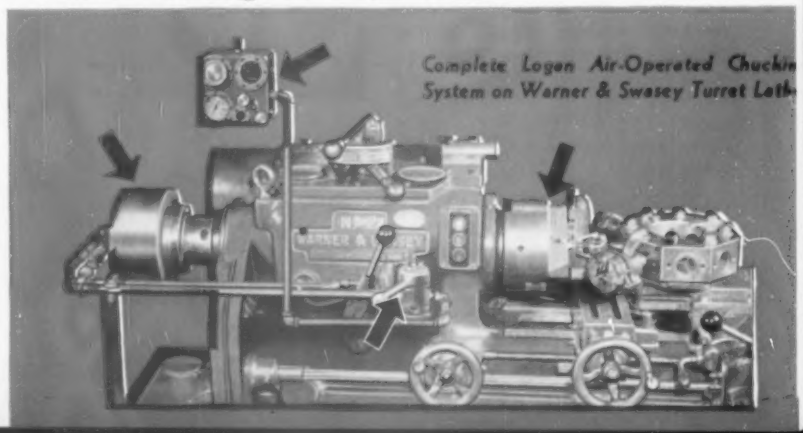
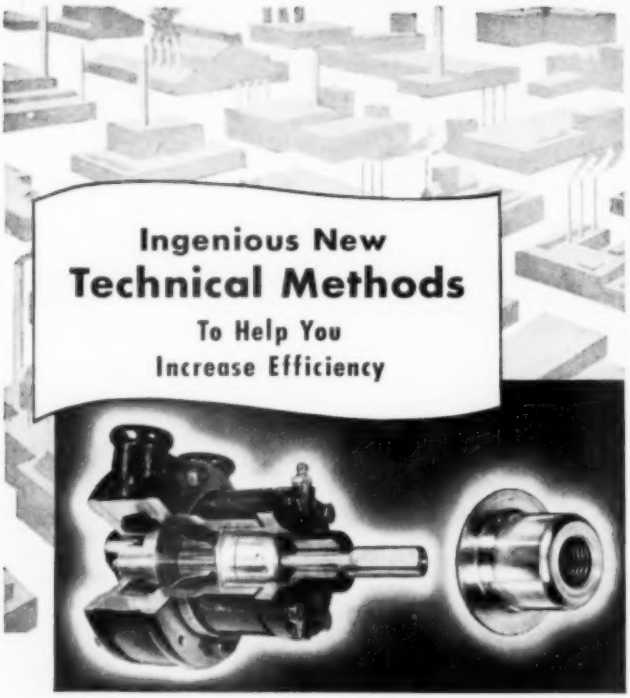
CHUCKS • CYLINDERS • VALVES • PRESSES • SURE-FLOW COOLANT PUMPS



Complete Logan Air-Operated Chuckin System on Warner & Swasey Turret Lath

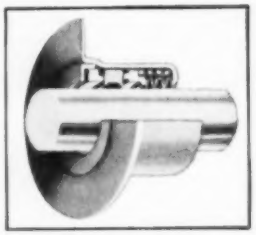


New Cartridge Seal Solves Rotating Shaft Sealing Problems

Stepped-up efficiency in sealing of rotating shafts can now be accomplished with a new Cartridge-type Seal mounted on the shaft.

The Cartridge-type Seal shown above is mounted within a Tuthill Pump. The seal contains all parts in one housing cup and insures positive double sealing. A high grade permanent lubricant is contained within the inside chamber of the housing.

Surfaces within the Cartridge-type Seal are lapped flat to within a few millionths of an inch to insure perfect mating. And, being a complete unit, only one mounting face is necessary. Clamps are eliminated, and adjustments or alignments are not required. Simply push the Cartridge-type Seal onto the shaft, tighten mounting screws and that's all.



Cartridge-type Seal

Just as new engineering developments increase efficiency and performance, so can workers' efficiency be increased through the use of chewing gum. The act of chewing helps relieve nervous tension, thus helping to make the work go smoother and easier. That's why plant owners everywhere more and more are making Wrigley's Spearmint Chewing Gum available to all.

Complete information may be obtained from
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AC-72

To maintain maximum accuracy in drilling operations, use the bushing that's precision made for the job...use Acme. Write for catalog.

Acme Industrial Company

Makers of Hardened and Ground Precision Parts

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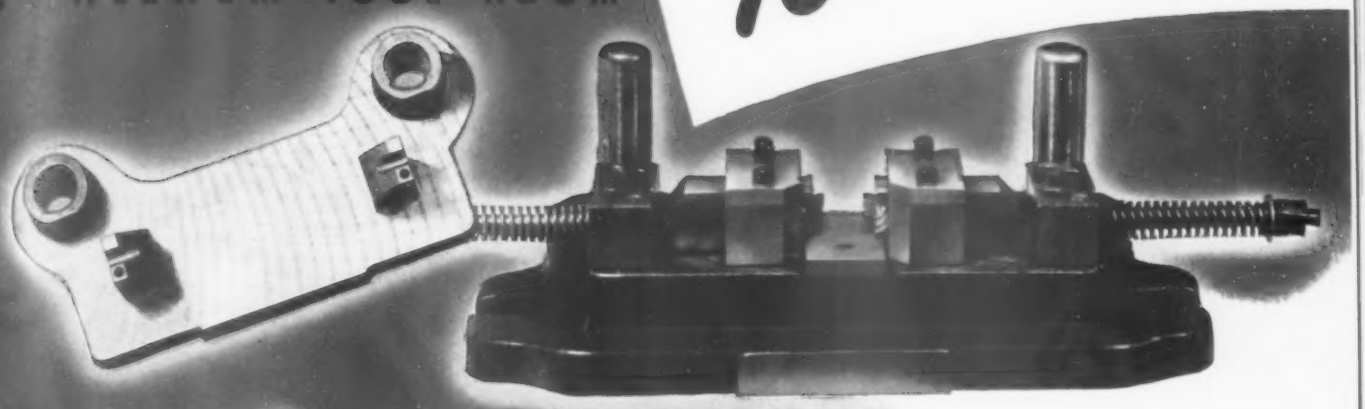
THE SERVICE SHOP TO INDUSTRY FOR MORE THAN 25 YEARS

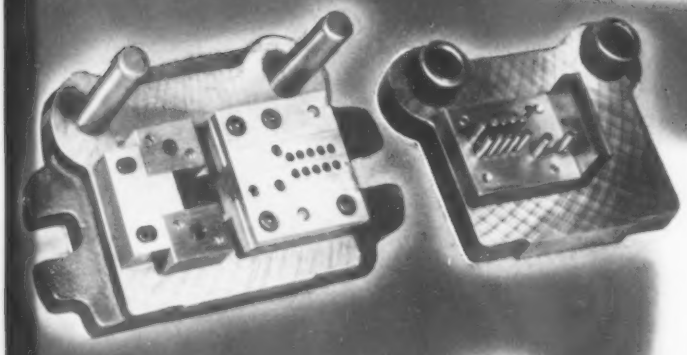
BTR

BETHLEHEM TOOL ROOM

The Safe-hardening TOOL STEEL



Squeezing, punching, and forming dies made from BTR. This general-purpose tool steel is a dependable choice for a wide range of tools and dies.



BTR . . . one of our most popular grades . . . is a great deal more than just an "oil-hardening" tool steel. Though often selected primarily for its safe-hardening characteristics, BTR is a favorite with toolmakers because . . .

It is easy to machine and heat-treat
It is high in both wear- and shock-resistance
It has low distortion in heat-treatment

BTR is backed by years of making good in tool and die shops. Toolmakers have confidence in its ability to harden in oil at low quenching temperatures, without fear of cracking hazards. Important, too, is the general utility of BTR. Use it for a wide range of tool and die jobs and you'll probably find, as others have, that it replaces several grades you're now using. BTR is reliable; you can count on it.

Call your nearest Bethlehem Tool Steel distributor or Bethlehem sales office. They'll give you full details and arrange for prompt delivery.

QUICK FACTS ABOUT BTR

	C	Mn	W	Cr	V
Typical Analysis:	0.90	1.20	0.50	0.50	0.20

Annealing: 1450 F. 202 Brinell
Hardening: 1475 F. oil-quench
Tempering: 325 to 400 F. Rockwell C 58 to 62
Toughness and Wear-Resistance: Good
Distortion-Resistance: Good
Resistance to Decarburization: Very Good
Machinability: Very Good
Application: For all general-purpose tools and dies which require a safer-hardening grade than carbon tool steel.

BETHLEHEM STEEL COMPANY
BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by
Bethlehem Pacific Coast Steel Corporation

Export Distributor:
Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BTR . . . one of Bethlehem's fine tool steels

Only M & M builds ALL 3: CIRCULAR SAW SAW BLADE BLADE GRINDER

CLIMB MILLING PRODUCTION!

NOT SO EASY TO GET WITH CONVENTIONAL METHODS, BUT COMMON PRACTISE WITH MOTCH & MERRYWEATHER

Slitting Saws

Triple-Chip METHOD

The M. & M. Triple-Chip tooth contour and dual drive adaptors make climb milling profitable in slitting operations.

STRAIGHT, ACCURATE SLOTTING FOR LONG LENGTHS.

The Motch & Merryweather Dual Drive renders saw keyways unnecessary giving positive, equalized driving power.

Higher production fully realized with greater accuracy, – that's the rule with climb milling when performed with M. & M. Slitting Saw Blades. The teeth cut in the direction of the feed. Motch & Merryweather Slitting Saw Blades give you the rigidity essential to today's stiff production requirements through our exclusive Triple-Chip tooth form, which imparts extra strength and breaks up the chip load. Dual drive adaptors deliver equalized transmission of power. A straight, accurate cut makes possible a deep, thin slot without danger of breakage. Better finish is another valuable result.

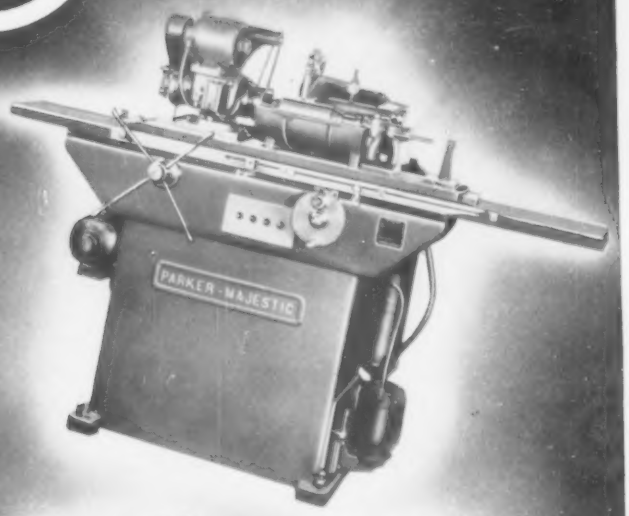
Ask for our Bulletin "T-8"

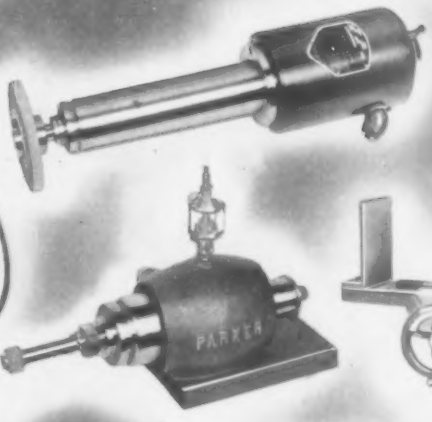
CUTTING TOOL DIVISION

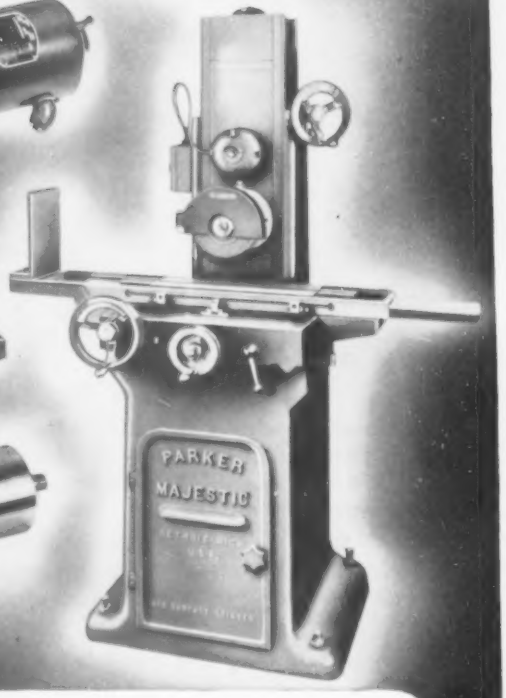
THE MOTCH & MERRYWEATHER MACHINERY CO.
PENTON BUILDING • CLEVELAND 13, OHIO

AT YOUR COMMAND • AN UNPARALLELED EXPERIENCE IN CIRCULAR SAWING

PRECISION MACHINES PM PARKER • MAJESTIC







Since 1907, the name of Parker has been a part of the progress of the automobile industry.

In 1915, Parker introduced the basic principle of ball bearings in grinding manufacture—a major advance in grinding which was unknown at that time.

A few years later the Parker Ball Bearing was patented to meet high speed and precision requirements and has been in use ever since.

Further research and engineering development brought forth the well-known Parker Majestic External and Internal Grinding Machines, each machine representing a great advance in simplicity of operation and precision.

The latest tooling development of the company is the Parker Majestic No. 2 Surface Grinder that provides new accuracy and flexibility for small grinding operations.

These many products of Parker Majestic will continue to serve the great automotive industry in the future, keeping pace with its demands for speed, accuracy and dependability.

MANUFACTURED BY

MAJESTIC TOOL AND MANUFACTURING COMPANY

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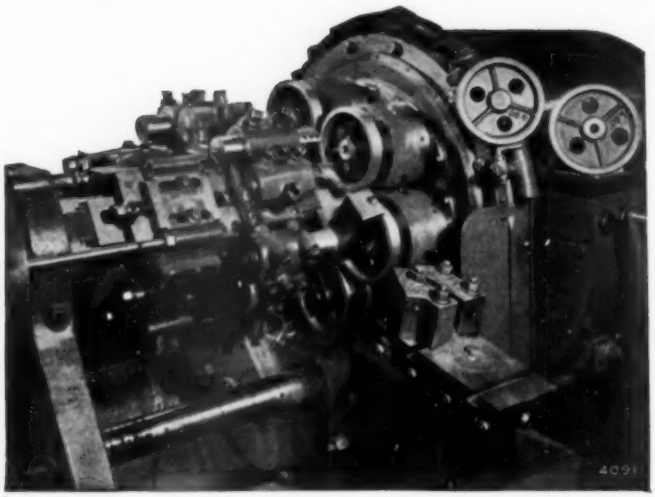

GEAR BLANKS ARE TURNED ACCURATELY AND SPEEDILY ON

"BAIRD" AUTOMATIC CHUCKING MACHINES

Here is shown a "Baird" No. 76H Chucking Machine, set up for turning, facing and boring gear Blanks made of a Special Cast Iron having a Rockwell hardness—85—90 B Scale.

The O.D. is finished turned to 6.800 plus or minus .001 and both faces are finished to 1.000 width, plus or minus .001.

The Hole is finished bored and reamed .750 diameter to plug gage and is concentric with the O.D. turning within .001 total indicator reading.

The work is held in Standard "Baird" Three Jaw Contracting Chucks, using stud type jaws for gripping. (The Spindle Turret is shown partially indexed to better illustrate the method of chucking.)

This gear is completely turned as shown to the required accuracy at the rate of 55 pieces per hour.

Selection of a spindle speed for each position, which is a special Baird Feature, permits high Spindle speeds in the finishing positions where carbide tools are used to produce the fine accurate surfaces required.

When you have Turning Operations that should be done profitably

"ASK BAIRD ABOUT IT."

THE BAIRD MACHINE COMPANY
STRATFORD, CONN.

THE NEW SAFETY "UTILITY"

MARKING OUTFIT

Holder Holds Nine Sizes of Type From 1/32" to 1/4"

Designed for light stamping work, the "Utility" outfit is ideal for marking etched plates, tags, keys, stock checks; brand names or stock numbers on steel bars; special coding, serial numbering, identification, inspection and other marking where two or more characters are required.

Send for Literature and Prices

M.E. CUNNINGHAM CO.
SAFETY STEEL STAMPS

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Lost any diamonds lately?

—then it's a cinch you'd better change to the dresser with the

"EDUCATED DIAMONDS"

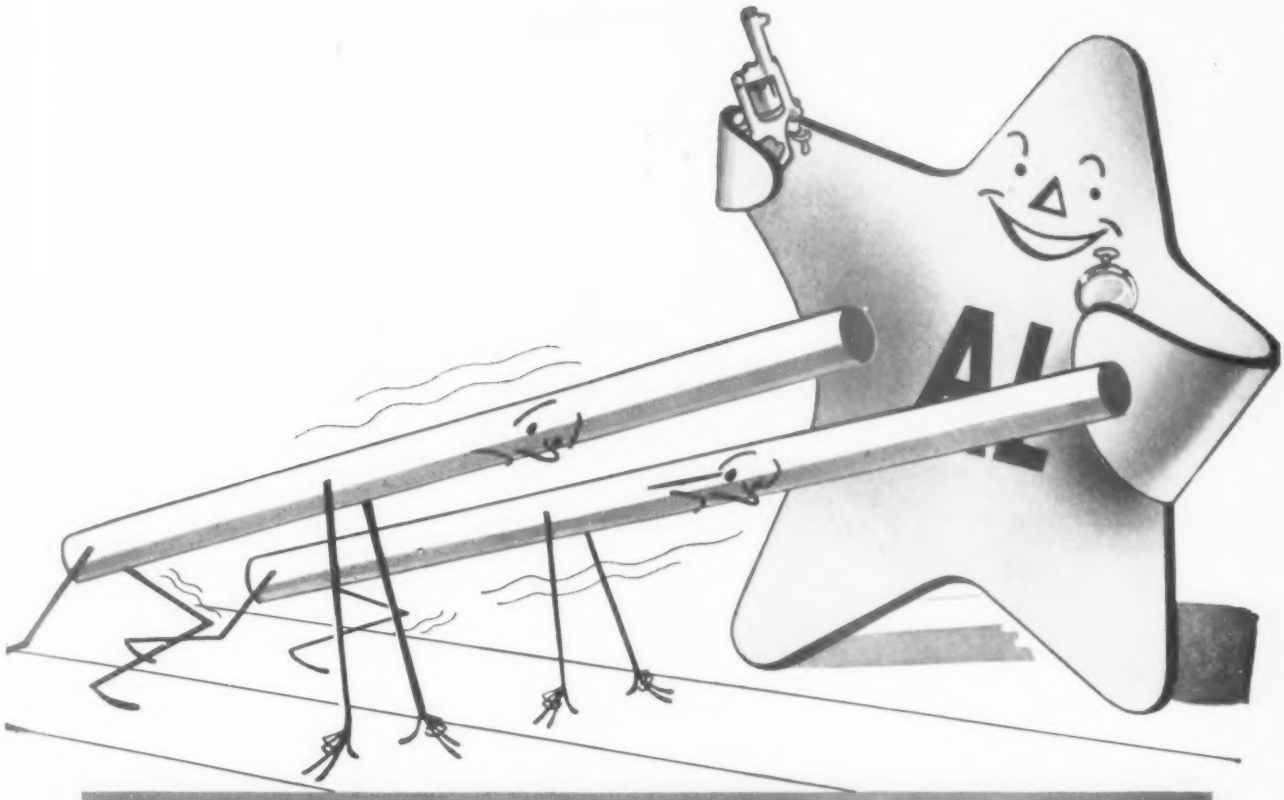
(They stand abuse . . . and *can't* come loose!)

Imbedded in a matrix of super-hard Carboloy Cemented Carbide, these keen-cutting diamond points stand *real abuse* . . . they can't come loose! They hold on "for dear life" throughout their entire period of usefulness.

You not only save on diamond replacement and remounting, but you can operate at faster traverse speeds.

Savings in diamonds, savings in time! Worth investigating? Sure it is. Drop us a line asking for free booklet No. DR-480. There's no obligation . . . and you stand to save up to 40% on dressing costs! *Carboloy Company, 11101 E. 8 Mile Street, Detroit 32, Mich.*

DIAMOND DRESSERS
by CARBOLOY ®



Why start a PRODUCTION RACE with Drill Rod that's already over-worked?

Get *your* copy of our new book on

"CUTTING TOOL MATERIALS"

Every production man can use this 32-page book to advantage—it gives a complete and clear comparison of the characteristics and best uses of all types of Cutting Materials. *Write for your copy.*

ADDRESS DEPT. TE-67

Now you can get High Speed Drill Rod in the smaller sizes that is *unspent,* full of stamina—capable of better performance and longer cutting life than ever before. Allegheny Ludlum has perfected a new special process of *hot-drawing* these small sizes—avoiding the frequent anneals necessary with repeated cold-draws down to size, accompanied by severe strains, and with each reheating taking some of the life out of the steel.

The result is High Speed Drill Rod that can show you maximum hardness, and something extra in toughness when hardened and tempered—a fine-grained steel with small, evenly distributed carbides that produce maximum cutting ability and tool life.

This product is available to you in the *grade* you're accustomed to using, too—all grades and types of High Speed Steels, as well as high carbon-high chrome Die Steel types. • Why not secure its advantages right away—get in touch with your local A-L representative or distributor.

ALLEGHENY LUDLUM STEEL CORPORATION
Pittsburgh, Pa.

TOOL STEEL DIVISION: DUNKIRK, N. Y.

Fine Tool Steels Since 1854 WAD 1777

San Bernardino, Calif.,
August 11, 1946.

The Cushman Chuck Co.,
Hartford,
Connecticut.

Gentlemen:

It occurred to me that you might be interested in one of your chucks which I have.

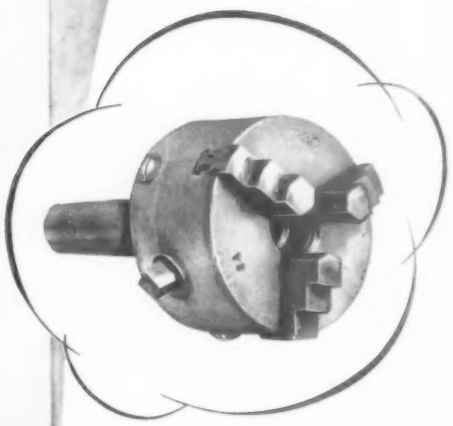
This chuck belonged to my grandfather and then to my father. My grandfather was past eighty when he died 37 years ago. My father had a gun store and repair shop about 70 years ago and used it there. It is still in perfect condition. It has the name CUSHMAN and No. 24. No doubt your records will show when it was made.

Do you know any of your chucks as old as this that are still in use?

I am a machinist employed by the Santa Fe R.R. and have this chuck on a little lathe in my workshop at home.

Yours truly,

F. W. Davis



UNRETOUCHED PHOTOGRAPH.
CHUCK MADE ABOUT 1876.

A Tribute to American Craftsmen

Naturally we were proud to hear of this Cushman Chuck which has faithfully served no less than three generations of machinists . . . and is still going strong. But what we like best about this letter is something written between the lines . . . a story of family pride in fine craftsmanship and fine tools which is a fortunate American heritage.

THE CUSHMAN CHUCK CO.
Hartford 2, Conn.

Comprehensive Series of
CUSHMAN POWER CHUCKS
and
AIR CYLINDERS
are now available.
Write for Catalog PO63 and Bulletins

Consult
CUSHMAN
Chucking Engineers Since 1862

Another LATROBE first!

Designed for Intermediate Service

...where the full properties of the more costly higher alloy high speed steels are not required!

LATROBE DESEGATIZED BRAND OF DISPERSED-SEGREGATE HIGH SPEED STEELS

This new **ELECTRITE MV** family of high speed steels is the product of years of research by Latrobe Electric Steel Co. metallurgists. Developed specifically to fill the need for Intermediate Alloy High Speed Steels, the MV family is suitable for uses where higher alloys are not required.

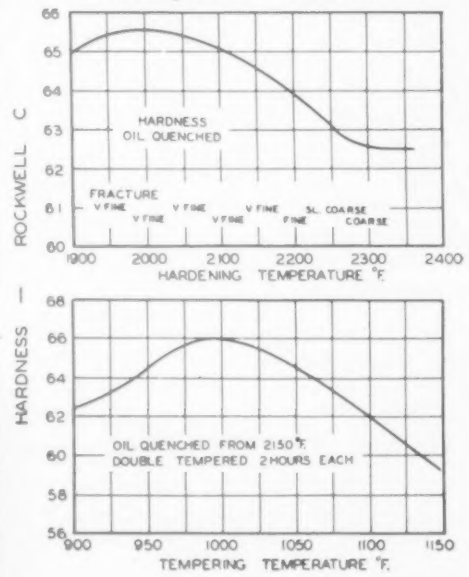
The introduction of these new steels marks another step forward in Latrobe's continuing efforts to produce for Industry better steels for better tools at lower cost.

These intermediate high speed steels are recommended for small drills and reamers, thread chasers, taps, pipe taps, etc., wood-working knives and cutters and for body stock for carbide-tipped drills and reamers. Our sales engineers will be glad to assist you in selecting the proper grade for your particular applications.

LATROBE ELECTRIC STEEL CO., Latrobe, Pa.

TE-4

Heat Treating Data — Electrite MV-2



TYPICAL ANALYSES

	C	Cr	Mo	Va
MV-1	.80	4.10	4.25	1.10
MV-2	.88	4.10	4.25	2.00
MV-3	1.18	4.10	4.25	3.15
MV-4	1.40	4.10	4.25	4.15

Shown at right are hardening and tempering curves of MV-2 grade.

GTD BUYS AMPCO

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GREENFIELD TAP AND DIE CORPORATION

TAPS DIES GAGES SCREW PLATES TWIST DRILLS REAMERS END MILLS PIPE TOOLS

GREENFIELD, MASSACHUSETTS
UNITED STATES OF AMERICA

TO OUR CUSTOMERS:

"Greenfield" is pleased to announce the purchase of the Ampco Twist Drill Corporation of Jackson, Michigan.

Ampco is a well-known maker of twist drills, reamers and end mills. It will be operated as a division of the Greenfield Tap and Die Corporation under the management of Frank J. Sikorovsky, President of Ampco.

The trademark GTD-AMPCO will be used on tools manufactured by this new division.

With the acquisition of Ampco, "Greenfield" will now be in a position to offer distributors and consumers a more complete line of high quality cutting tools and gages as well as finest engineering service on taps, dies, drills, reamers, end mills and gages.

Very truly yours,

GREENFIELD TAP AND DIE CORPORATION

D. G. Millar

President

DGMillar:G

Special Taps? YOU BET!

The tap user who needs a type or size not listed in the GTD Catalog can put his threading problem up to "Greenfield's" staff of threading tool engineers with complete assurance that he will get the tap that will do the job. A special thread form or pitch? A special point? An unusual shank or square? A reamer pilot? Whatever the problem, there are 75 years of tapping know-how ready to solve it, plus the ingenuity of men trained to creative engineering.

From the drawing board, your "special" goes to a new "specials" department where only specials are made; it is not sandwiched into the production schedule between lots of regular taps. Here are the latest in tap-making machines. Here are the best of the toolmaking craftsmen. Here is an inspection set-up usually found only in gage-making plants.

No matter how complicated your "special" may be, it is made with greatest speed — and at the most reasonable cost. This is the ultimate test of special tap-making ability.

"Greenfield" carries in stock hardened blanks in all standard sizes and dimensions which can be finished to special pitches or thread forms at short notice.

If you have a special tap problem, get in touch with the "Greenfield Man" through your nearest "Greenfield" distributor.

GTD GREENFIELD

World's Leading

THREADING TOOLS

When you buy GTD "Greenfield", you get a quality of product that comes from the world's largest, most modern threading tool plant and its research staff of threading engineers – PLUS SERVICE from the leading distributors and GTD "Greenfield's" field men in every industrial center.

GREENFIELD TAP and DIE CORPORATION GREENFIELD, MASSACHUSETTS

Broaches by Illinois Tool

custom designed for superior performance

To attain maximum efficiency in your broaching operations, Illinois Tool Works broach engineers work closely with your production executives to develop broaches exactly suited to the detailed requirements of your application. This design service . . . combined with the work of master tool makers and specially built production and inspection equipment . . . is your assurance of superior performance with Broaches by Illinois Tool Works.

Typical broaches illustrated above are a small cross section of the wide range of types and sizes produced at Illinois Tool Works for manufacturers in every branch of the metal working industry. Whatever your application, the Illinois Tool Works design-production team will deliver broaches to do your specific job more accurately . . . more economically. Call an Illinois Tool Works broach specialist today!

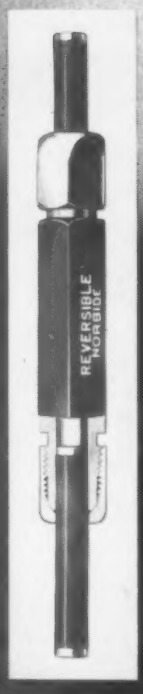
Headquarters for Engineered Cutting Tools

ILLINOIS TOOL WORKS

2501 N. KEELER AVENUE • CHICAGO 39, ILLINOIS

In Canada: Canada Illinois Tools, Ltd. Toronto, Canada

TO OBTAIN THE LONGEST WEARING GAGE
Request a NORBIDE Gage
then *DOUBLE* gage life again by making it *REVERSIBLE.*



NORBIDE plug gages, along with many other types of NORBIDE gages, have long been known to gage users for their exceptionally long-wearing qualities. NORBIDE gages are made of Norton Boron Carbide which is the hardest material made by man. Gage life has often been increased up to one hundred times by the use of NORBIDE members in the gages.

Some gage suppliers are further doubling plug gage life by producing reversible gages. As one end of either the "go" or "no go" member becomes worn, it may be removed from the handle and reversed with the unworn end thus being made available for further long gage life. Your regular gage supplier should be able to provide NORBIDE gages or, for further information, we invite your inquiries.

NORTON COMPANY, WORCESTER 6, MASS.

THREAD AND FORM ROLLING
TOOLS and MACHINES EXCLUSIVELY!

REED Cam-Actuated, Triple Die THREAD ROLLING MACHINES

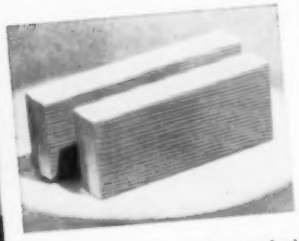
REED Cylindrical and Flat THREAD ROLLING DIES

REED KNURLS

REED THREAD ROLLS

A Complete THREAD ROLLING SERVICE

RED LABEL DIES
for Reciprocating Thread Rollers



RED LABEL Dies are the product of our many years of skill and accumulated experience as pioneers in the specialized field of thread and form rolling. Available for rolling all types of machine screws, sheet metal screws and lag screws.

Send for General Bulletin 5-1

REED ROLLED THREAD DIE CO.
Manufacturers of
THREAD ROLLING MACHINES AND DIES—
KNURLS—THREAD ROLLS.
WORCESTER 2, MASS., U.S.A.

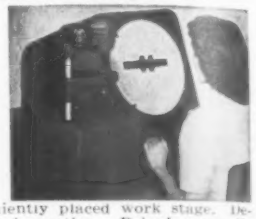
REED RTD Co

SCHERR *aids to precision*

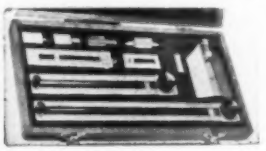
Will not shift while measuring —
CHESTERMAN HEIGHT GAGE

A big, sturdy stabilized instrument. Fine adjustment by screw operated from knurled [illegible] on base (see photo) eliminates movement of instrument while measuring. Finger pressure on two lugs frees split [illegible] for rapid vertical adjustment of head. 2½" long vernier in place of the normal ⅝" vernier provides greater visibility without need of magnifier or removing gage from work. English and metric readings one on each face of column. In sizes from 12" to 48"—capacities sufficient for the most unusual measurements.

Visual Precision Inspection for All Shops—the
WILDER MODEL B MICRO PROJECTOR



An instrument priced for any shop's budget, that will save its cost many times by preventing rejects. Spot-checking with the Wilder at the start and during a production run, instantly reveals any tendency to go beyond tolerance due to wear of tools or other cause. This is a bench type tool, with an almost vertical screen, on which the magnified image is thrown, and a conveniently placed work stage. Designed and built for continuous quantity inspection. Priced unusually low. Write. Also in Model A for general use.



GAGE BLOCK UTILITY SET

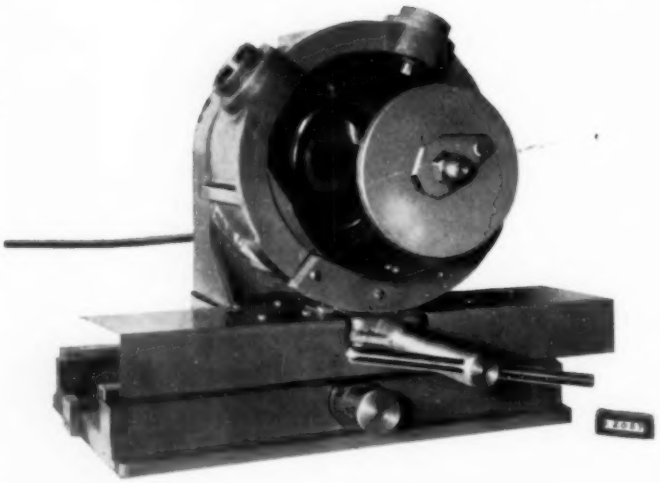
Quick adjustable type holders. Greatly expands the usefulness of standard gage blocks. The set includes four holders—2", 4", 8" and 12", two jaws each for inside and outside measurements, a 60 deg. center point, and a substantial height gage base. Every shop can profitably use one or more of these economically-priced sets.

Write for full details on these tools

GEO. SCHERR CO., Inc. 199-A LAFAYETTE STREET NEW YORK 12, N. Y.

SWARTZ TOOL PRODUCTS CO., INC.

13330 Foley — Detroit 27, Michigan



A DOUBLE INDEXING FIXTURE TO MACHINE PORTHOLES IN CYLINDER BARREL UNDER TWO SPINDLE GANG DRILL. CYLINDER ROTATES WHILE MOVING HORIZONTALLY.

- DESIGNERS -
- BUILDERS -

SPECIALIZING IN
ALL TYPES OF
HOLDING FIXTURES
FOR MACHINE SHOP
PRODUCTION

BUILDERS OF
STANDARD DRILL
JIGS AND FIXTURE
LOCKS

ASK FOR CATALOG 941

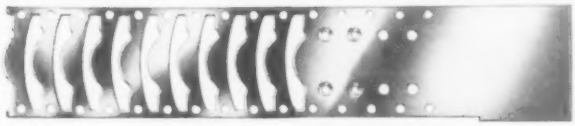
130 parts per minute from .062 stock

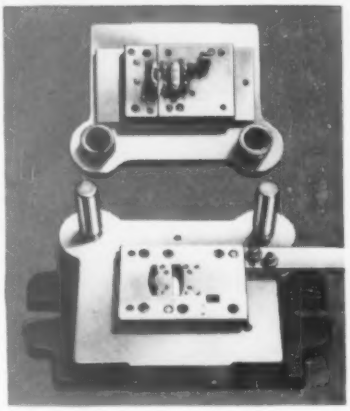
tolerance held within .002"

. . . using

DANLY PRECISION DIE SET

Six-stage progressive die produces 65,000 steel stampings per grind





In the stamping operation shown here, .062 cold rolled steel parts for electric shavers are pierced, swedged, sized, and blanked in an intricate six-stage progressive die. A Danly Precision Die Set, consisting of a semi-steel punch holder and all-steel die shoe, is used to take full advantage of the die maker's precision.

The six-stage die produces these parts at a rate of 130 per minute. Over-all tolerances are held within .002", and *an average of* 65,000 *parts are obtained between grinds.*

As a result of the close operating precision that is maintained, tumbling is the only secondary operation that is required to finish the piece.

Built to precision tolerances (guide posts and bushings ground to limits of two ten-thousandths of an inch) the operating accuracy of Danly *Precision* Die Sets insures close tolerances and long tool life.

Danly has a wide range of standard stock sizes available that can be quickly assembled and delivered to help you save time and money.

Danly engineering service—For helpful information on die sets of any size, standard or special, for any type of press operation, consult our engineering department. No obligation.

sequence of operation

Following is the sequence of operations performed as the C. R. Steel Strip is fed through the six-stage progressive die:

1st Step: Notch edge for feed stop.
2nd Step: Pierce pilot holes.
3rd Step: Pilot in outer holes. Pierce two holes.
4th Step: Swedge two holes.
5th Step: Pierce holes to size.
6th Step: Blank.

DANLY NATION-WIDE ★ ASSEMBLY SERVICE

Danly offices in 10 key cities give immediate attention to your orders. Assembly plants (marked with stars) stock interchangeable parts for quick assembly and delivery of any standard die set to your specifications.

★ **Chicago 50,** 2100 S. 52nd Ave.
★ **Cleveland 14,** 1550 E. 33rd St.
★ **Dayton 2,** 990 E. Monument Ave.
★ **Detroit 16,** 1549 Temple Ave.
★ **Grand Rapids,** 113 Michigan Ave., N. W.
★ **Long Island City 1,** 47-28 37th St.
★ **Los Angeles 54,** Ducommun Metals & Supply Co., 4890 S. Alameda
● **Milwaukee 2,** 111 E. Wisconsin Ave.
● **Philadelphia 44,** 18 W. Chelten Ave.
★ **Rochester 4,** 16 Commercial St.

get this *free* bulletin

Illustrates how Danly's Special Machining and Welding Service can save you time and money for unusual die set applications.

DANLY

DANLY MACHINE SPECIALTIES, INC.
2100 SOUTH 52ND AVENUE, CHICAGO 50, ILLINOIS

PRECISION DIE SETS...STANDARD AND SPECIAL | MECHANICAL PRESSES AND PRESS EQUIPMENT

Behind every manufactured product
is the tool engineer
Behind every tool engineer
is Milne Tool Steel

A. MILNE & CO.
(ESTABLISHED 1887)

Save Hours of Machining Time by Using

MILNE HOLLOW DIE STEELS

MILNE HOLLOW DIE STEELS
Are Stocked in the Following Grades:

WATER HARDENING — OIL HARDENING
HIGH CARBON HIGH CHROME (Air Hardening Type)

Typical Applications Are:

Cut Edges	Collets	Blanking Dies
Ring Dies	Circular Cutters	Drawing Dies
Punch Shells	Ring Gauges	Slitter Knives
Cams	Tube Dies	Forming Dies
Sleeves	Hardened Bushings	

HOLLOW DIE STEELS are economical for all types of round tool and die work for the following reasons:

1. Smoothness of Exterior and Interior Surfaces.
2. Superior Degree of Annealing.
3. Less Waste of Material.
4. Prompt deliveries from stock.

Send for our booklet on HOLLOW DIE STEEL as well as Pricing Chart and Cost Study, also stock list of standard sizes. This material is stocked in our seven warehouses located—

New York 14, 745 Washington St.
Boston 27, 631 E. 1st St.
Chicago 7, 17 N. May St.
Pittsburgh 12, 1000 Constance St., N.S.
Philadelphia 6, 337-339 N. Orianna St.
Cleveland 5, 11110 Avon Avenue
New Britain, 172 Stanley St.

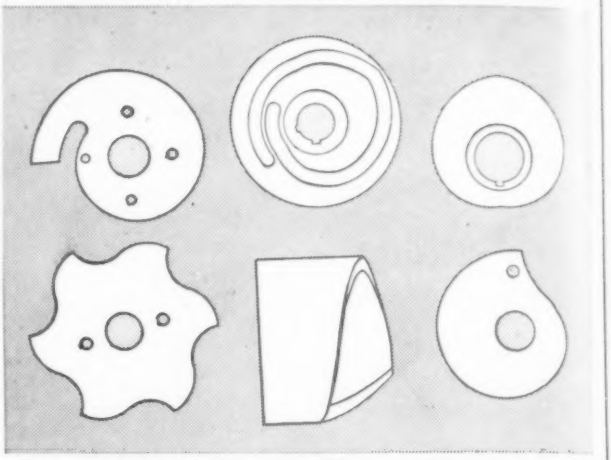
and on the Pacific Coast:

For the States of Oregon, Washington, Idaho and Montana

Pacific Machinery & Tool Steel Co.
630 S.E. Belmont Street
Portland 14, Oregon

America's Leading Tool Steel Specialists

CAMS — ECCENTRIC PARTS IRREGULAR CONTOURS



Let AMCAM Handle Those "Headache" Jobs

For years, the superior know-how of American Cam Company has maintained the reputation of producing the finest quality cams at the lowest prices in the quickest time. No quantity too large.

Also specialists in Cams and Layouts for BROWN & SHARPE Automatic Screw Machines.

AMCAM — AMERICAN CAM COMPANY
HARTFORD 1, CONN.

Still the Best Performer

3P HEAD TYPE PUNCHES

IMMEDIATE DELIVERY on all STANDARDS
★ SPECIALS TO ORDER ★

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3P Punches Consistently Give An Outstanding Performance In The Stamping Industry. For A Durable, Cost-Saving, Dependable Punch, 3P Has No Equal.

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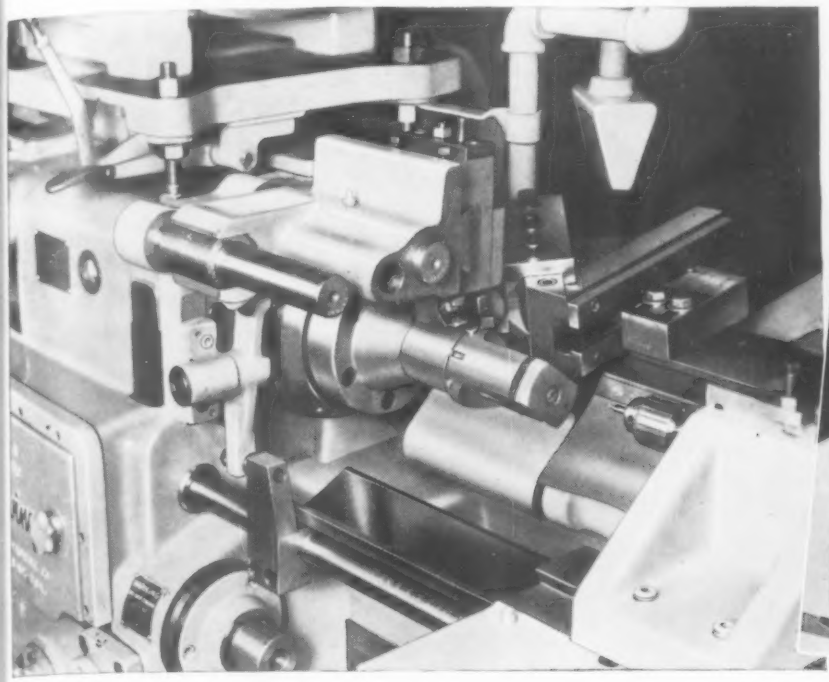
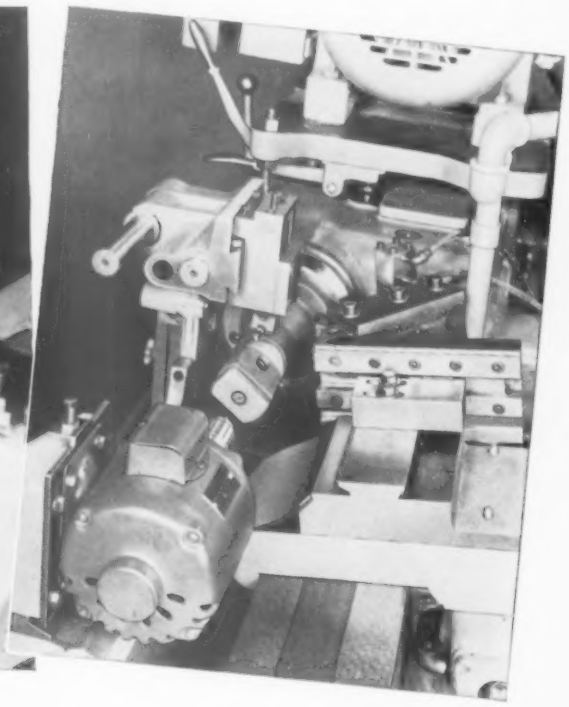
Stocked and Distributed by
ACCURATE BUSHING COMPANY.....Garwood, New Jersey
BELL-WELL SALES CO.....Milwaukee 4, Wisconsin
THE DIE SUPPLY COMPANY.....Cleveland & Dayton, Ohio
STANDARD DIE SUPPLY, INC.....Indianapolis 4, Indiana

MACHINE OF THE MONTH

PREPARED BY THE SENECA FALLS MACHINE CO. **"THE Lo-swing PEOPLE"** SENECA FALLS, NEW YORK





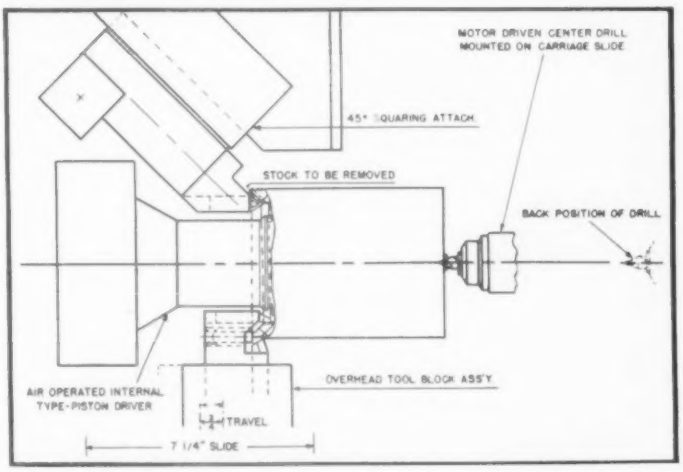
MODEL "LR" AUTOMATIC Lo-swing LATHE with SPECIAL TOOLING for FAST BORING and CENTERING OPERATIONS on PISTONS

Problem: To bore, chamfer, face and turn skirt of piston and center closed end true with rough bore.

Solution: The Model "LR" Automatic Lo-swing Lathe selected was equipped with the special tooling shown in the close-up views above and in the line drawing.

The air operated centering arbor is fitted with a spring loaded centering plate which centers the piston from the bottom of the bore, while three air operated jaws center the open end. The piston is held back against the centering plate by an air operated pull bar and by a pin introduced thru the gudgeon pin hole. After the piston is clamped in position, the boring, turning and facing of the open end of the skirt is machined with tools mounted on the overhead slide. Simultaneously the chamfering operation is made with a 45° squaring attachment, mounted on the rear of the lathe. The centering of the closed end is accomplished with an electrically-operated centering head. All tools operate simultaneously and a high hourly production is obtained. The operation is entirely automatic, the operator simply loading and unloading the parts.

Consult our Engineering Department for Automatic Lo-swing Lathe with tooling engineered for your particular machining problems.

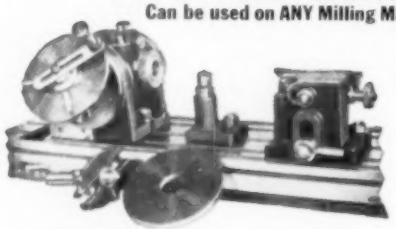

MOTOR DRIVEN CENTER DRILL MOUNTED ON CARRIAGE SLIDE
45° SQUARING ATTACH.
STOCK TO BE REMOVED
BACK POSITION OF DRILL
AIR OPERATED INTERNAL TYPE-PISTON DRIVER
OVERHEAD TOOL BLOCK ASS'Y.
TRAVEL
7 1/4" SLIDE

SENECA FALLS MACHINE CO., SENECA FALLS, N. Y.

PRODUCTION COSTS ARE LOWER WITH Lo-swing

CUT MILLING COSTS *with* KEMPSMITH STANDARD ATTACHMENTS

Universal
DIVIDING HEAD
Can be used on ANY Milling Machine



A Kempsmith Universal Dividing Head is a precision tool, designed and built to retain accuracy. Combines simplicity and convenience with rigidity and accuracy. High number indexing attachment, spiral cutting mechanism and chuck with adapter also available. Ask for Bulletin No. 119.

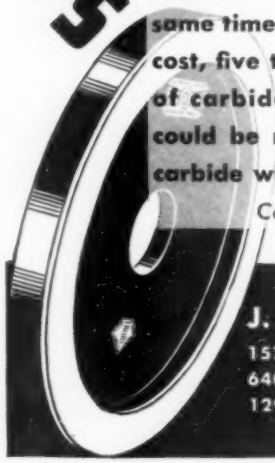
Kempsmith Standard Attachments broaden the scope of your milling machine . . . lower capital investment . . . save in set-up time.

KEMPSMITH MACHINE CO.
1847 SOUTH 71st STREET
MILWAUKEE 14, WIS., U. S. A.

KEMPSMITH ARBORS
in all popular sizes or types. Adaptable to ANY make of milling machine with standardized spindle.

KEMPSMITH
Precision Built Milling Machines Since 1888

SECOMET DIAMOND



Here's a worth-while investment. Impregnated with carefully selected diamond grains of uniform size, insuring perfect finish with maximum efficiency, "Secomet" Diamond Wheels remove in the same time and at greatly reduced cost, five to six times the amount of carbides or hard metal that could be removed with a silicon carbide wheel.

Catalog on request.

J. K. SMIT & SONS, INC.
157 Chambers St., New York 7, N. Y.
6400 Tireman Ave., Detroit 4, Mich.
129 Adelaide St. West, Toronto, Ont.

Increase **THE LIFE OF TAPS AND REAMERS!**

BEFORE discarding taps and reamers because you think they are not doing perfect work, make this simple test! Try them in a Ziegler Floating Tool Holder!

In many cases you'll find that the trouble was due not to the tool being faulty but rather to a faulty set-up. By using a tool holder which automatically compensates for spindle alignment inaccuracies of as much as 1/32" radius or 1/16" diameter, you can quickly tell where the blame should be placed. What you'll save on tools that you would otherwise prematurely discard will pay for a Ziegler Tool Holder many times over in the course of a year. Try it and see!

Made To Fit Any Machine

Furnished with male or female taper, straight, threaded or special shanks to fit any machine used for tapping or reaming.

W. M. Ziegler Tool Co.
1930 Twelfth St.
Detroit 16, Mich.

WRITE FOR CATALOG

Ziegler ROLLER DRIVE **FLOATING HOLDER** *for* **Taps** *and* **Reamers...**

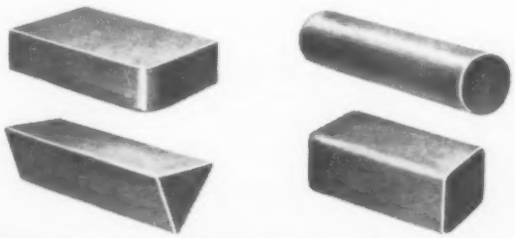
Here's Proof of TECO CARBIDE UNIFORMITY!

MANY tool men are skeptical of test runs. "How will it perform in regular production, lot after lot?" they want to know. The typical case above, shows how Improved TECO Cemented Carbide answers that question.

In fact, Improved TECO Cemented Carbide has been averaging 3 to 10 times more pieces per tool than other carbides. Doing it consistently, job after job. Permitting higher speeds and feeds. Keeping schedules at peak and tool costs extremely low

TRY A RUN with Improved TECO on any established carbide job. Run as usual and check the increase in pieces per grind—grinds per tool—total tool life. Send details of your job set-up when ordering any tools, for proper recommendation. Or have one of our representatives or distributors call.

TUNGSTEN ELECTRIC CORP., 39th St., Union City, N. J.
Representatives: Indianapolis; Cleveland; Chicago; Detroit; St. Louis; Bakersfield, Calif.



IMPROVED TECO CEMENTED CARBIDE

Manufacturers of Tungsten Carbide—from ore to finished material—for over a quarter century

M·B MODEL M-CR 75,000 R.P.M.

"JUNIOR" Pneumatic GRINDER

4 TYPES—2 lengths of spindle extension; 2 types of air control valves, one for continual operation and one for intermittent work. Steel body for safety. No lubrication required. Abundance of power. Lightweight 12 ounces. Whole length 5⅜", length of body 3". Accommodates mounted grinding wheels, rotary files, etc. on ⅛" dia. shanks. Speed such as to operate Tungsten Carbide burrs, rotary files, etc. to their full efficiency.

Write for Literature

M·B PRODUCTS
130-134 E. Larned St.
Detroit 26, Michigan

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OTHER PNEUMATIC GRINDERS:

MODEL SS-SR
100,000 RPM

★

MODEL U-TR
60,000 RPM

★

MODEL HD-CR
40,000 RPM

★

Also M-B Automatic AIR-LINE FILTERS and LUBRICATORS

• • •

NEW BENCHMASTER

DEEP THROAT 4 TON punch press

● Here's the press you need for punching large sheet steel and other stock in a jiffy. Its deep throat gives extra capacity—now enables punching to the center of a 17½" circle! Extra sturdy frame is heavily reinforced at all stress points. Press weighs 340 lbs.!

The new Benchmaster retains all the quality, engineering advantages and proven performance features of the standard model—yet gives you CAPACITY seldom encountered in larger presses! Available as a bench model or with legs as a standard extra. *Write for bulletin giving complete details.*

benchmaster MANUFACTURING COMPANY
3943 WEST PICO BOULEVARD
LOS ANGELES 8, CALIFORNIA
WORLD'S LARGEST PRODUCER OF SMALL PUNCH PRESSES

Precision WORK LIKE THIS!

Valve Stem for Fuel Injection System, Jet Propulsion Engine. MATERIAL: Stainless Steel

Ball and Race Unit for Radar Instrument. Lapped to No. 3 Micro Finish. .0001 Accuracy all over. MATERIAL: Nimonic

is BETTER . . .
if it's made by FULLER!

Holding precision limits to one ten thousandth of an inch is everyday procedure with Fuller skilled craftsmen. Under the supervision of the six Fuller brothers, some really phenomenal results in accuracy have been achieved. If you have a precision part or tool that demands out-of-the-ordinary machining skill to produce . . . you can completely rely on Fuller craftsmanship to follow your most exacting specifications. It's a matter of family pride.

Now . . .

FULLER TOOL Co.

SKILLED CRAFTSMEN

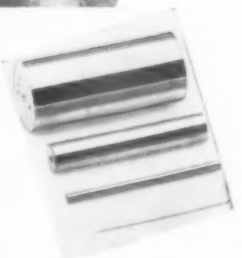
SPECIAL TOOLS • PRECISION MACHINING
3956 WEST ELEVEN MILE ROAD
P.O. BOX 161 • BERKLEY, MICH.
Telephone LINCOLN 2-5600
GUILD

Van Keuren THREAD MEASURING WIRES

STANDARD EQUIPMENT EVERYWHERE

Van Keuren measuring wires are the accepted standard equipment for making measurements on thread gages, taps, worms, splines and spur gears. We carry a complete stock of sizes for measuring U. S. Standard, Whitworth, Metric, British Association, Pipe, Acme and 29° Worm threads. Special wires of any diameter in the range from .002" to 1.5708" are made to order.

Our large supply of blanks insures prompt delivery. Van Keuren thread measuring wires are manufactured to National Bureau of Standards specifications. They are hardened, ground and lapped by precision methods developed over a quarter-century. They are accurate within .00002" for roundness and straightness and within ± .000025" for size. Special sizes are made to any tolerance required.



The New 1948 Catalog and Handbook No. 34 is a 208 page volume, which has been in preparation for nearly two years. It contains complete information and prices on Van Keuren precision gages and instruments as well as valuable new engineering formulas and tables. Price $1.00 postpaid.

THE Van Keuren CO., 174 Waltham St., Watertown, Mass.

29th YEAR

Light Wave Equipment • Light Wave Micrometers • Gauge Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Measuring Wires • Carboloy Plug Gages

for GREATER *Versatility . . .*
and more PRODUCTION

Use R and L Tools on your Turret Lathes and Screw Machines!

Production Records always tell the wisdom of tooling with R and L!

There's no end to the additional operations you can perform on Turret Lathes and Screw Machines when you utilize R and L Turning Tools. For example, in the illustration above, turning and forming a special shape on end of part is accomplished while drilling or reaming! Users of R and L Turning Tools say that the multiple operations now possible are just like adding extra spindles to their present equipment. With this simple tool, there's unlimited "Combined Operations" you can perform: drilling and turning; turning, centering and burnishing; pointing and form turning; turning two diameters—all with one single, simple tool.

By all means, if you are not fully aware of what these tools can do—IN YOUR SHOP—TO INCREASE YOUR PRODUCTION CAPACITY, write us at once for our idea-packed R and L Booklet which gives full details of R and L Tools and shows many of the "combined operations" set-ups.

NEW! R AND L KNURLING TOOL

Here's a tool with half the weight of comparable models but still affording a better grip and control of knurls. It's available in a complete range of sizes, like all R and L Tools!

R AND L TOOLS

1825 BRISTOL STREET

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HOW MIDWEST MANUFACTURER GOT

24 TIMES MORE WORK

FROM HIS DRILLS

● Think of it! 24 times more work from a high-speed drill . . . that's the record made by a mid-western manufacturer of farm machinery in drilling cast iron engine blocks. Originally, the tapered shank, high-speed 53/64 drill used in this work had to be sharpened after drilling only three holes. *Given a .0001" application of Racine-Lundbye Process Chrome, this same type drill now bores 72 holes!* The extreme hardness obtained by Racine's flash-chrome finishing gives cutting tools an amazingly wear-resistant surface . . . cuts down friction to reduce damage from heat. Learn how the Racine-Lundbye Process can effect savings in your plant. Write today.

RACINE Lundbye Process Chrome
GIVES TOOLS 300% LONGER LIFE

RACINE Tri-Chrome
RECLAIMS VITAL PARTS AND TOOLS

Racine Plating Company, Inc.
RACINE, WISCONSIN
Specialists in Chrome Plating
COPPER • NICKEL • CADMIUM • POLISHING • PICKLING

"The STANDARD of COMPARISON.. For QUALITY and ACCURACY"

IMMEDIATE DELIVERY!

- QUALITY
- SERVICE

DRILL JIG BUSHINGS

Precision made from finest oil hardened tool steel — ASA Standard — featuring concentric ground lead to insure perfect alignment.

Complete stocks maintained at all times by exclusive distributors throughout the U.S. and Canada, for immediate free delivery.

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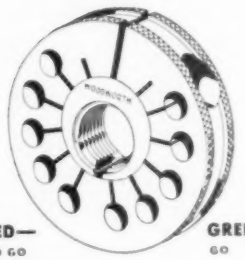

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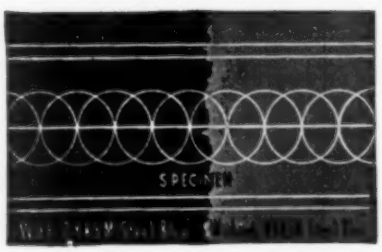

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Continental ENGINEERING IN CUTTING TOOLS

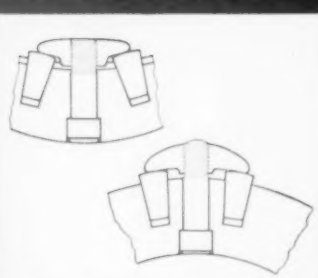
Makes the Big Difference!

Below: Rough milling a casting with a Continental Inside Cone Face Milling Cutter. This type of cutter is especially economical in rough milling because the principal direction of blade adjustment is toward the periphery where major wear occurs.

CONTINENTAL cutting tools made by Ex-Cell-O *(from standard counterbores and face milling cutters to all types of broaches and special carbide-tipped tools of intricate design)* are now used almost universally throughout the metal-working industry in shops both large and small. This exceptionally wide experience in designing and manufacturing cutting tools is one of the reasons why every Continental cutting tool leaving the Ex-Cell-O plant—no matter what the cutting material or the purpose of the specific tool may be—faithfully represents the high Ex-Cell-O standard . . . *assurance of correctness in design, thoroughness in manufacture, and the most practicable of accuracy and production in operation.*... Prompt delivery can be made of Continental standard and special tools—call in your Continental representative today, or write to Continental in Detroit.

Above: Continental Inside Cone Face Milling Cutter for roughing and general purpose work.

Above: Continental Outside Cone Face Milling Cutter for finishing and general purpose work.



Above: These illustrations show how blades are locked in Continental Face Milling Cutters—inside cone type at the left and outside cone type at the right. One clamp locks two blades securely in place — no wedges, pins or set screws are used — no special tools are required.

48—13

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These features help cut cost per piece on NEW BRITAIN CHUCKERS

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- *Variable Chucking Pressures* in last positions prevent distortion of thin-walled or fragile pieces.

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THE NEW BRITAIN MACHINE CO.

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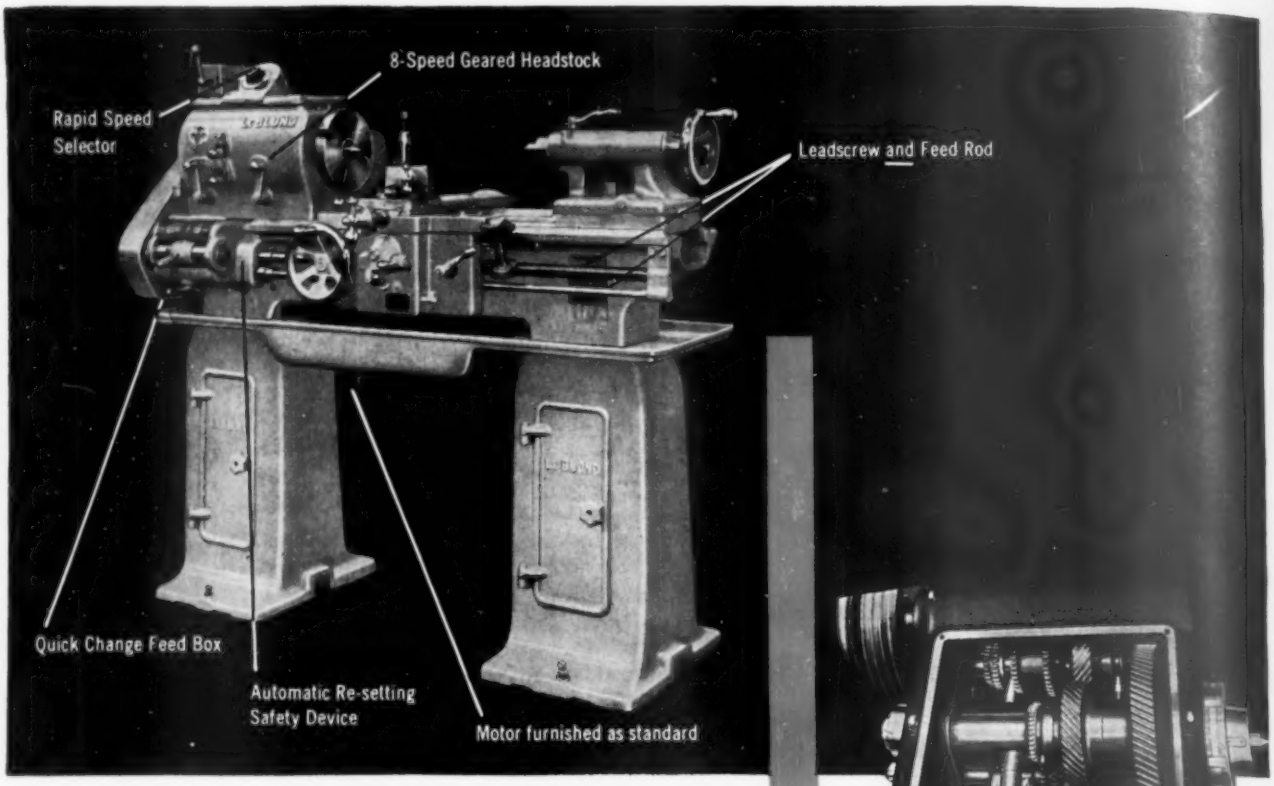

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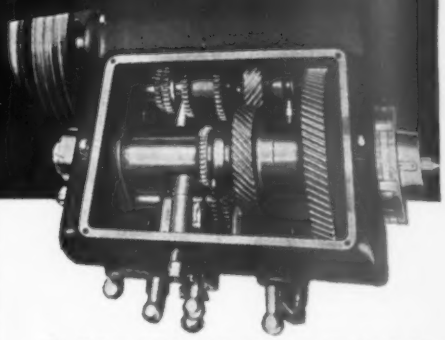

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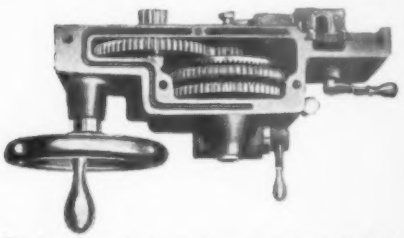

2. One-piece Apron with positive jaw feed clutch Single lever controls both length and cross feed; safety interlock prevents double engagement.

3. Inverted Vee-type Bed is built exceptionally heavy, provides rigid base for carriage and tailstock travel, assures long life accuracy.

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